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# INTERNATIONAL CLINICS

## A QUARTERLY

OF

ILLUSTRATED CLINICAL LECTURES AND  
ESPECIALLY PREPARED ORIGINAL ARTICLES

ON

TREATMENT, MEDICINE, SURGERY, NEUROLOGY, PEDIATRICS,  
OBSTETRICS, GYNECOLOGY, ORTHOPEDICS,  
PATHOLOGY, DERMATOLOGY, OPHTHALMOLOGY,  
OTOLOGY, RHINOLOGY, LARYNGOLOGY,  
HYGIENE, AND OTHER TOPICS OF INTEREST  
TO STUDENTS AND PRACTITIONERS

BY LEADING MEMBERS OF THE MEDICAL PROFESSION  
THROUGHOUT THE WORLD

EDITED BY

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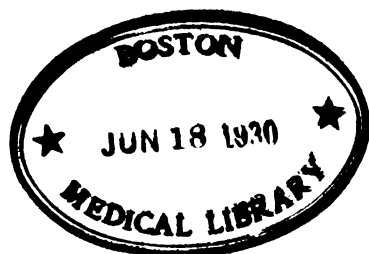
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# Treatment

## THE TREATMENT OF ACUTE NEPHRITIS IN CHILDHOOD

BY JOHN LOVETT MORSE, A.M., M.D.

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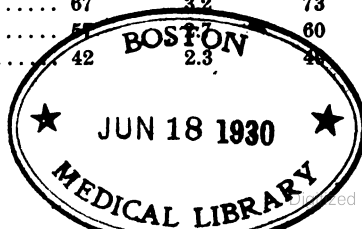
It is impossible to treat acute nephritis in children rationally without a general knowledge of their caloric needs and of the metabolism at this age. A brief review of the main facts in regard to these points, therefore, is not out of place before taking up the treatment in detail.

### CALORIC NEEDS OF CHILDREN

It is pretty well established that a man weighing 70 kilos (154 pounds) expends about 2500 calories in 24 hours while taking moderate exercise. When taking active exercise he expends 10 or 15 per cent. more, and while resting 10 or 15 per cent. less. The caloric needs of infants have also been pretty well worked out, but there are very few data as to the caloric needs of children. It has been pretty certainly established, however, that the caloric need, reckoned per kilo of body weight, diminishes steadily with age. This diminution in the caloric need varies directly with the heat loss, which, in turn, depends on the relation of the body surface to the body volume. The relative proportion of the surface to the volume diminishes steadily with age. It is also certain that the need of albumin diminishes steadily with age. Camerer's observations on his own five children over a long period of years showed that their need in grams or calories per kilo, averaged for both sexes, was about as follows:

Age.	Water.	Albumin.	Calories.
2 to 4 years .....	75	3.6	75
5 " 7 " .....	67	3.2	73
7 " 10 " .....	57	2.8	60
11 " 14 " .....	42	2.3	48

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In order to avoid unnecessary detail I shall take up, for purposes of illustration, the caloric needs at but three ages,—four, eight, and twelve years. It is easy to determine approximately from them the needs at other ages. In round numbers, the caloric need, reckoned in calories per kilo, at these ages, is as follows:

4 years	.....	75 calories.
8 "	.....	60 "
12 "	.....	50 "

A combination of various tables of weights for given ages shows that the average weights are approximately as follows:

4 years	.....	15 kilos.
8 "	.....	22 "
12 "	.....	32 "

A combination of these average weights with the albumin need of Camerer's children shows an albumin need, in round numbers, at these ages, as follows:

4 years	.....	55 grams.
8 "	.....	60 "
12 "	.....	75 "

In the typical adult weighing 70 kilos, 100 grams of albumin is sufficient to replace the nitrogenous cell waste.

A combination of these various weights with the total caloric need of Camerer's children makes the caloric need at these ages, in round numbers, as follows:

4 years	.....	1125 calories.
8 "	.....	1325 "
12 "	.....	1600 "

Von Noorden has shown that an adult can get along very well for two or three weeks on 60 grams of proteid in 24 hours. On this basis the average minimum proteid need of children of average weight at these ages is as follows:

4 years	.....	32 grams.
8 "	.....	36 "
12 "	.....	44 "

A combination of these average weights with the need of water of Camerer's children shows that the average need for water of children at these ages is approximately:

4 years .....	1100 c.c.
8 " .....	1250 "
12 " .....	1350 "

There is very little reliable information as to the amount of urine passed during childhood. It is known, however, that it is relatively greater than in adults, especially during early childhood. It is also known that the amount varies within widely different limits. Holt has combined the figures of a good many observers and arrived at the following results:

2 to 5 years .....	500 to 800 c.c.
5 " 8 " .....	600 " 1200 c.c.
8 " 14 " .....	1000 " 1500 c.c.

#### PRINCIPLES OF TREATMENT OF ACUTE NEPHRITIS

The treatment of every diseased organ whose continued action is necessary for the life of the individual may be divided, outside of directly curative methods, into two parts: The first comprises those measures which diminish the work which the organ has to do; the second, those which help the organ to do its work. Unfortunately, we can do little or nothing to help the acutely inflamed kidneys do their work, and we must, therefore, devote our attention almost entirely to diminishing the work which they have to do.

The kidneys do not excrete all substances with equal facility. Some are excreted with difficulty and others very easily. A knowledge of the comparative ease of excretion of various substances under normal conditions will help us materially in our efforts to spare the kidneys when they are diseased. The most important of the substances which are excreted with difficulty are urea, creatinin, phosphates, and, under certain conditions, water. Other less important substances are pigments, hippuric acid, and inorganic sulphates. All these substances are, of course, derived primarily from the food. It is of great importance, therefore, to know in what foods they are most abundant, in order to avoid their ingestion as far as possible.

*Urea* is chiefly derived from the proteids of the food. While all articles of food contain a certain amount of proteid, meat and eggs contain but little else. This fact is well recognized. Few remember, however, how much proteid there is in milk; nearly as much as of fat and sugar. Milk, therefore, is not the innocuous

food in nephritis that it is often supposed to be. Milk alone is not a suitable diet in acute nephritis. Given in the large quantities in which it usually is, it is both wasteful and harmful. When just enough is given to meet the proteid need of the body, the total caloric value is too low. When given in sufficient quantities to meet the caloric needs of the body, the amounts of proteids and of water are too high. These facts are more evident from the following figures:

*Milk and Cream Mixtures.*—It has already been mentioned that, according to von Noorden, an adult can get along very well for days or even weeks on 60 grams of proteid in 24 hours. On this basis the proteid needs of children are at

4 years	.....	32 grams.
8 "	.....	36 "
12 "	.....	44 "

The following amounts of milk are required to supply this need for proteid:

4 years	....	800 c.c. of milk (27 ounces).
8 "	....	900 " " (30 " ).
12 "	....	1100 " " (37 " ).

If the milk contains 4 per cent. of fat, 4.5 per cent. of sugar, and 4 per cent. of proteids, as is usually reckoned,

800 c.c. of milk	=	575 calories.
900 " "	=	650 "
1100 " "	=	800 "

This number of calories, however, is only about half as many as are wanted.

The following amounts of milk are required, in round numbers, to supply the total caloric needs:

4 years	.....	1550 c.c. of milk (1125 calories).
8 "	.....	1850 " " (1325 " ).
12 "	.....	2200 " " (1600 " ).

Such large amounts of milk, however, give about twice as much proteid as is needed, and hence throw much unnecessary work on the kidneys, which should be spared as much as possible. They also contain much more water than is necessary, and under certain conditions may in this way, too, injure the kidneys.

The need of water and the excess of water contained in the milk required to supply the caloric needs at various ages is shown in the following table:

Age.	Water Need.	Excess of Water in Milk.
4 years .....	1100 c.c.	250 + c.c.
8 " .....	1250 "	375 "
12 " .....	1350 "	575 + "

The usual method of keeping patients with acute nephritis on a strictly milk diet is, therefore, not only irrational, but injurious.

If cream is substituted for a portion of the milk, the caloric value of the mixture is materially increased, while the amount of proteid remains essentially the same. It is rarely advisable to make more than one-fourth of the mixture cream, on account of the danger of disturbing the digestion. More cream may be substituted, however, if the mixture is diluted with water. The effect of the substitution of cream for a portion of the milk is shown in the following table:

600 c.c. of milk and 200 c.c. of 16 per cent. cream = 800 calories ( 800 c.c. of milk = 575 calories).									
675	"	"	225	"	"	"	- 900	"	( 900 " " = 650 "
825	"	"	275	"	"	"	- 1100	"	(1100 " " = 800 "

Compared with the caloric needs of children four, eight, and twelve years of age, these quantities lack but 325, 425, and 500 calories.

The milk and cream contain approximately 85 per cent. of water. Hence, 800 c.c., 900 c.c., and 1100 c.c. of milk and cream are equal respectively to 675+ c.c., 750+ c.c., and 925+ c.c. of water. That is, when compared with the water needs of children of four, eight, and twelve years, they lack about 425 c.c., 500 c.c., and 425 c.c. of water respectively. This lack of water can, of course, be easily made up by giving the necessary amount of water in addition to the milk and cream mixture.

Von Noorden claims that, as far as the kidneys are concerned, the form in which the proteid is taken makes no difference; that is, that it is immaterial whether it is in the form of meat and eggs or milk, the total amount of proteid alone being of importance. There is considerable evidence to show that this is not so, however, but that the excretion of urea is relatively greater with meat than with milk proteids when the same amounts are taken. Milk pro-



teids, moreover, throw less work on the digestion and diminish intestinal putrefaction. Meats also contain a certain amount of extractives. Red meats are no more dangerous on this account than white meats.

The deficiency of calories in the milk and cream mixtures can easily be made up by the use of foods rich in carbohydrates and fat and poor in proteids. Such foods are, for example, butter, sugar, cereals, and bread. It may be worth while to consider the caloric value of some of the common foods suitable for children. An ounce of bread contains about 75 calories, mostly in the form of starch. A slice of bread 4 inches square and  $\frac{3}{8}$  of an inch thick weighs about an ounce. A tablespoonful of boiled rolled oats weighs about an ounce and contains nearly 20 calories, mostly in the form of starch. A slice of bread has, therefore, about the same caloric value as four tablespoonfuls of oatmeal. Four rounded teaspoonfuls of granulated sugar are about an ounce and contain about 115 calories. An ounce of butter is a piece about  $1\frac{1}{2}$  inches square and  $\frac{3}{4}$  of an inch thick, and contains 225 calories, practically all in the form of fat. An ounce of grapes represents a little more than 20 calories.

Two slices of bread and 1 ounce of butter are thus worth 375 calories, and three slices of bread and an ounce of butter, 450 calories, while four tablespoonfuls of oatmeal and two teaspoonfuls of sugar are equal to more than 125 calories.

*Creatinin* is derived from creatin. This is contained in meat and especially in meat extracts and meat broths. Meat extracts and broths contain little else, and hence have but little nutritive value. They are practically useless as foods and harmful because of the creatin which they contain. They should, therefore, never be given under any conditions whatever in acute nephritis. Vegetables contain no creatin and eggs and milk but very little.

*Phosphoric acid* is present in large amounts in meats, yolks of eggs, milk, and many vegetables. This is an additional reason why milk is not the innocuous food in acute nephritis which it is supposed to be. The addition of calcic carbonate to the food will, however, prevent the passage of a considerable amount of phosphoric acid through the kidneys and cause it to be excreted by the intestinal tract. A small amount of prepared chalk should, therefore, be given daily. The dosage is necessarily very inexact. I am in the habit of giving from 30 to 60 grains daily.

*Water* stimulates the function of the kidneys very powerfully. Moreover, when a large amount of water passes through the kidneys, the substances which are eliminated by them are diluted, and hence cause less irritation. For these reasons large amounts of water have been given as a routine treatment at all stages of all forms of nephritis. When the condition of the kidneys at the beginning of acute nephritis is considered, however, the advisability of the administration of large quantities of water at this time seems very doubtful. The kidneys are congested and engorged with blood, the glomeruli and tubules blocked and the epithelium degenerated. Water at this time cannot overcome the resistance and cannot be eliminated. It can only increase the congestion and irritate the inflamed kidneys further. Not being eliminated, it increases the edema. The supply of water should be limited at this stage, therefore, only enough being given to satisfy the thirst. If the kidneys are eliminating water fairly easily, as shown by the amount of urine, considerable amounts of water are not only allowable, but advisable, even in the acute stage. Marked or even moderate edema is, however, a contraindication for large amounts of water, even if the kidneys are secreting fairly freely.

After the first few days the engorgement of the kidneys usually diminishes and the obstruction to the passage of water becomes less marked. Water may then be given more freely with advantage. An increase in the edema at this time also usually calls for a reduction in the amount of water.

During convalescence, when water is eliminated freely, it should be given in large quantities. At this time it not only does no harm, but does much good by flushing out the kidneys and weakening the solutions of the substances to be excreted.

*Drugs.*—The drugs which are most commonly used in the treatment of acute nephritis to incite diuresis are digitalis and its congeners, strophanthus and spartein; caffein and the preparations of theobromin; and the alkalies. It may be well to review the physiologic action of these drugs and to consider, in the light of this action, their applicability in the treatment of acute nephritis.

*Diuretics.*—Digitalis and drugs of its class have no direct action on the kidneys, but increase the flow of urine by strengthening the action of the heart, and thus sending more blood through the kidneys. The heart does not need stimulation in acute nephritis, how-

ever, and in the acute stage the kidneys are already engorged with blood. Any form of treatment, therefore, which increases the flow of blood to the kidneys at this stage is not only irrational, but may be harmful. In the later stages it may no longer be harmful, but is unnecessary.

Caffein, theobromin, and their preparations have a direct stimulant action on the renal epithelium. Their action on the heart is probably of no importance in this connection. Caffein by its action on the vasomotor center may cause such a contraction of the arterioles of the kidneys as to prevent any benefit from the stimulation of the epithelium. Theobromin and its preparations, such as diuretin, have no action on the vasomotor center, and are thus preferable to caffein. In the acute stage the renal epithelium is in no condition to respond to stimulation, and, moreover, stimulation may do harm by increasing the inflammation. In the later stages these drugs may be of use, but are usually not needed if the diet and the intake of water are regulated.

It is almost certain that the alkalies have no direct effect on the activity of the renal cells. Their action is probably the same as that of other diffusible bodies which are excreted by the kidneys and which during their excretion increase the flow of urine. The effect of the alkalies on the total nitrogen excretion is a very uncertain one. When the nitrogen of the urine is increased by their use it is probably usually due chiefly to a flushing out of the tissues. In many cases the relative amount of urea is increased by the administration of alkalies. As the object of treatment at the most acute stage is to spare the kidneys, and as water at this time is irritating to the kidneys, it hardly seems rational to give alkalies at this time to increase the work of the kidneys. Later on alkalies are often useful. They are, however, but little, if any, more effectual than the water in which they are given.

In general, therefore, the diuretic drugs are more likely to do harm than good in the early stages of acute nephritis, while later they are, as a rule, unnecessary.

*Cathartics.*—Although there is but little place for diuretics in the treatment of acute nephritis, cathartics and diaphoretics are often indispensable. When uremia is present or threatened free catharsis is of great service in eliminating or preventing the absorption of poisonous substances. Concentrated solutions of salines can

seldom be given to children on account of their taste and the size of the dose. Compound jalap powder and elaterin are most useful. Croton oil is seldom necessary. Even when there is no danger of uremia, it is always well to have one or two large, rather loose, movements from the bowels daily. Compound jalap powder and compound licorice powder are especially useful for this purpose. Although free catharsis does diminish edema to a certain extent, it is far inferior to diaphoresis for this purpose.

*Diaphoretics.*—The only object of diaphoresis is the removal of edema. It is certain that but little urea is eliminated in this way, and there is no proof that toxic substances are excreted by the skin. The application of heat externally is far safer and more effectual than the administration of drugs internally. Pilocarpin is the only drug powerful enough to be of any practical utility, but while very useful it is always dangerous because of its liability to cause edema of the lungs. This liability should, however, never prevent its use in emergencies. Hot-air baths, while more effectual than hot packs, are less useful for children. Unless a child is unconscious, it is very difficult to keep it in a hot-air bath long enough to get satisfactory results. They bear hot packs much better, as they are much less uncomfortable. The most satisfactory method of giving a hot pack is to put the child, wrapped in a blanket, into a tub of water at from 105° F. to 110° F., leaving it there from 15 to 20 minutes. It is then taken out, wrapped in a dry blanket, and kept surrounded by heaters for from one-half an hour to an hour. Diaphoretic measures should be continued as long as there is any considerable amount of edema. There is no object in continuing them longer. It is irrational to give large amounts of water while diaphoretic measures are being used. Water should be given sparingly at this time, not only because it tends to increase the edema, but also because it throws unnecessary work on the kidneys.

Poultices to the loins are probably of some use in relieving the congestion of the kidneys.

#### TYPES OF ACUTE NEPHRITIS

Cases of acute nephritis, as they are seen clinically, may be divided into three classes: (1) Those in which the secretion of urine is very small, the edema marked or increasing, and uremia present or impending; (2) those in which the amount of urine is

reduced, but not excessively so, the edema slight or moderate and not increasing, and in which there are no symptoms of uremia; and (3) those in the convalescent stage.

CLASS I.—In the first class of cases the kidneys are congested and engorged with blood, the glomeruli and tubules blocked, and the epithelium degenerated. They are able to excrete but little, and are practically impervious to water. They should be spared as much as possible by regulation of the food and limitation of the water. No more proteid should be given than is necessary to meet the minimum proteid need. It may be asked why it is not better to stop all proteids and thus spare the kidneys entirely. The answer is that during the first few days of starvation the excretion of nitrogen is but little diminished, and that on this account little or nothing can be gained by entirely cutting off the proteids. The proteids are best given in the form of milk and cream mixtures, which also meet a considerable proportion of the normal caloric needs. These mixtures also furnish a considerable proportion of the normal supply of water. In most cases it is inadvisable to give more water; if more is given, the normal supply should never be exceeded. Diuretics should not be given, as they are contraindicated. The bowels should be freely opened to aid in the elimination and to prevent the absorption of poisonous substances. Free sweating should be induced, preferably by the hot pack, to reduce the edema. Hot poultices should be applied to the loins and stimulation given, if necessary.

Such a strict limitation of the food and water is usually not very well borne for more than four or five days or at most a week. It are practically impervious to, water. They should be spared as is never necessary longer, however, as by this time the patient will have died or the kidneys have begun to functionate.

The amount of food and water must, of course, be varied in accordance with the age of the child. A child of 8 years, for example, has a normal caloric need of 1325 calories. It needs 60 grams of albumin and takes about 1250 c.c. of water. According to von Noorden, its minimum proteid need is 36 grams. Six hundred and seventy-five c.c. of milk and 225 c.c. of cream ( $22\frac{1}{2}$  oz. and  $7\frac{1}{2}$  oz.) will supply this minimum proteid need and also supply 900 calories, or more than two-thirds of the normal requirement. This amount of milk and cream should therefore be given. It also

furnishes about 750 c.c. of water, or three-fifths the normal amount. In most cases no more water is needed or advisable. If more is given it should not exceed 500 c.c., which is enough to bring the water up to the normal amount.

The following chart (Fig. 1) is illustrative of the treatment of a mild case of this type.

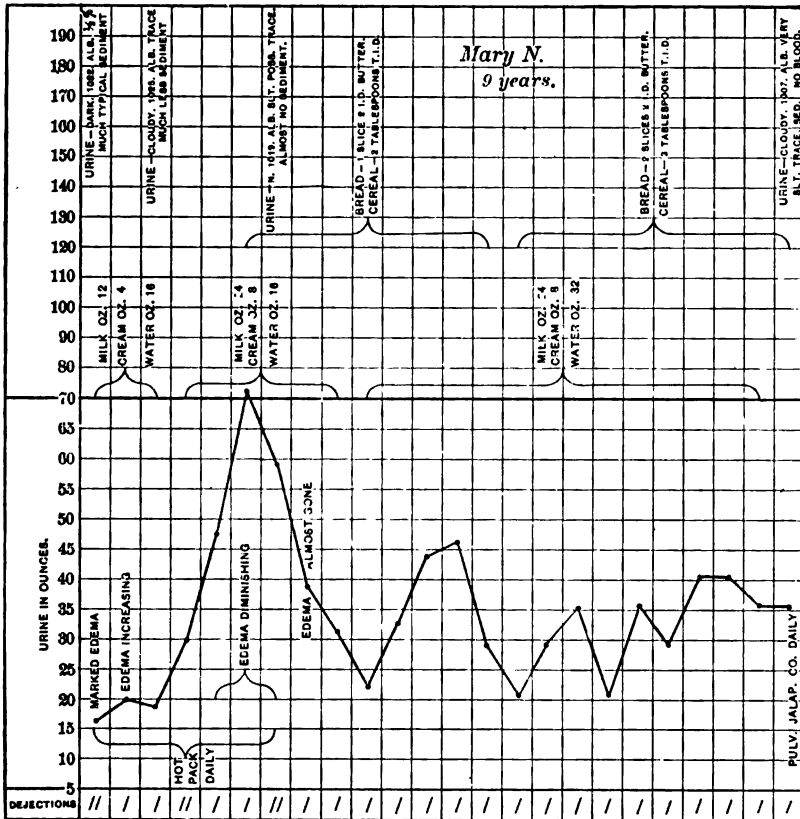


FIG. 1.—Chart illustrating the treatment of a mild case of nephritis.

**CLASS II.**—In the second class of cases the congestion of the kidneys and the blocking of the glomeruli and tubules is less. The kidneys are able to do a certain amount of work and are more or less pervious to water. The work which they have to do should still be kept as low as is possible consistent with the maintenance of a proper state of nutrition. The caloric needs should be met in full. The amount of proteid should not exceed the normal proteid need,

although it is not always necessary to limit it to the minimum proteid need. The proteid is best given in the form of milk and cream mixtures. The further caloric needs should be met with foods rich in fat and carbohydrates but low in proteids.

It is usually advisable to give at least enough water to meet the normal need. This should not be exceeded, if there is edema. If there is no edema, the supply of water should be regulated by the amount of urine. If the amount of urine is below normal when the normal amount of water is being taken, the water should be diminished, as it shows that the kidneys are not in a condition to allow water to pass freely. If the amount of urine is normal or above normal when the normal amount of water is being taken, more water should be given.

Diuretics are not contraindicated, but are usually not necessary. There should be one or two large, rather loose movements of the bowels daily. Hot packs should be continued, if there is edema; otherwise they are not only unnecessary but harmful.

In this stage, for example, a child of 8 years would take the same amount of milk and cream as in the very acute stage, or perhaps a little more. The additional 425 calories would be given, perhaps, in the form of bread and butter or oatmeal and sugar. Thus three slices of bread and one ounce of butter will provide 450 calories, or 4 tablespoonfuls of oatmeal with 2 teaspoonfuls of sugar and 2 slices of bread with  $\frac{1}{2}$  ounce of butter, 400 calories. Five hundred c.c. of water will bring the water up to more than the normal amount. If more is given, it should be in measured amounts, regulated to meet the indications.

The following chart (Fig. 2) is illustrative of a case midway between Classes II and III.

CLASS III.—In the convalescent stage there is little or no congestion of the kidneys and but little blocking of the glomeruli and tubules, while the epithelium is gradually returning to its normal condition. The kidneys are at least as pervious to water as under normal conditions. They should be spared, however, until all symptoms have ceased and some time longer. The principles of diet are the same as in the earlier stages. The proteid needs are best supplied by the milk and cream mixtures. If meats are given, the milk should be correspondingly cut down. The further caloric needs are met by fatty or carbohydrate foods. Vegetables and certain fruits are allowable.



Water should be forced. Diuretics, diaphoretics, and cathartics are unnecessary, but laxatives should be used. The child should be

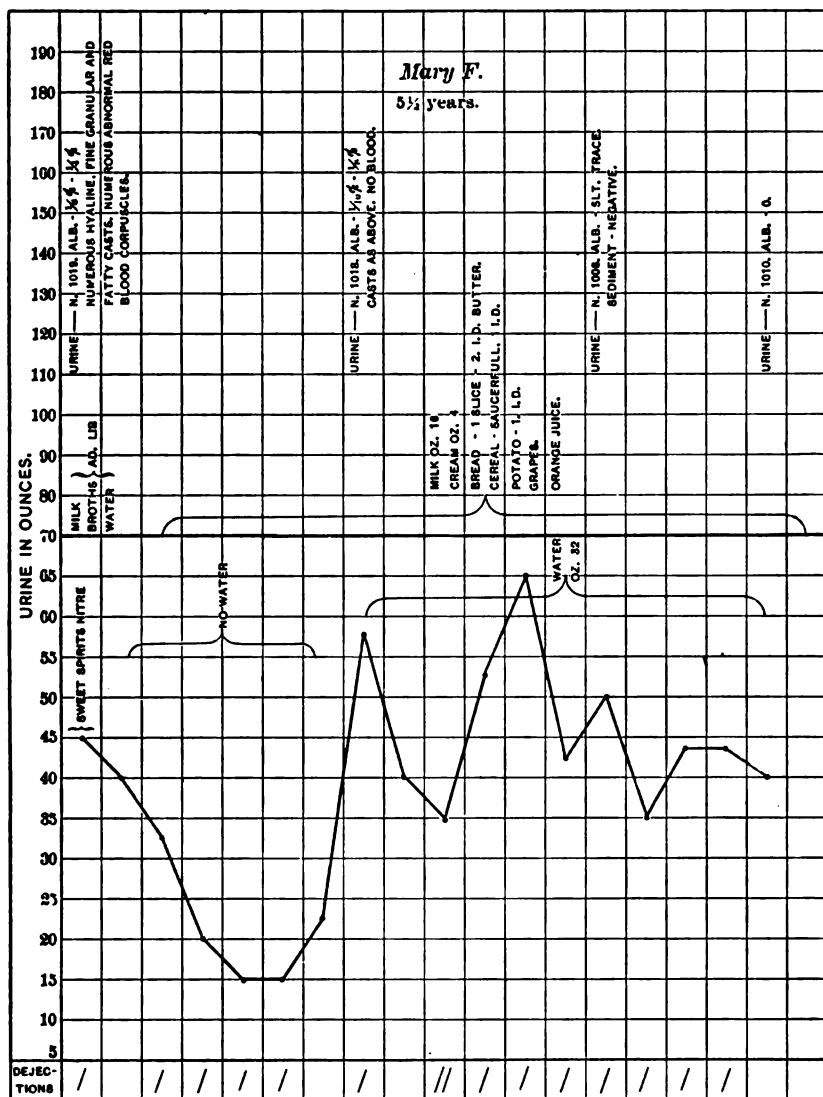


FIG. 2.—Chart illustrating the treatment of a case of nephritis progressing toward convalescence.

protected from exposure to cold, and, if circumstances permit, sent to a warm climate. Undue exertion must be avoided. The diet, care, and hygiene must be watched and the urine examined at frequent intervals for months after the disappearance of symptoms.

# THE THERAPEUTIC INDICATIONS OF KEPHIR

A CLINICAL LECTURE

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GENTLEMEN: You have often seen me prescribe kephir. It acts both as a food and as a remedy, and I look on it as a substance of the greatest value in the treatment of diseases of the stomach. During my course of lectures on therapeutics, a few years ago, I drew up the principal indications for its use. Since that time my experience with it has both increased and matured, so that I can now both confirm and define even more closely the therapeutic precepts which I felt authorized to propose.

Excellent monographs have been published on the natural history of kephir; you may refer, in particular, to that of Podwysotszky,<sup>1</sup> in which you will find the mode of preparation and of action of this substance.

In the majority of these publications kephir is presented as a food to be used in building up weakened patients. This is a restricted view of its worth, as we have here rather to deal with an excellent remedy whose indications and contraindications it is to your interest to be quite familiar with.

Let me first remind you in a few words what kephir really is. It is cow's milk that has undergone a special mode of fermentation. For this purpose a mushroom, called kephir-seed, is employed. Kern, who has carefully studied this seed, finds in it a short, thick bacterium with a voluminous spore at each end, whence its name *Dispora caucasia*, and a yeast, *Saccharomyces cerevisiæ*. The kephir ferment is therefore a mixture of two elements, under whose action milk undergoes a twofold fermentation: the one affects the lactose and produces lactic and carbonic acids and a small amount of alcohol; the other acts on the albuminoid substances, on the casein in particular, which latter undergoes partial precipitation and begin-

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<sup>1</sup> Kephir: Paris, C. Naud, 1902.

ning digestion, and for this reason we find both peptones and propeptones in kephir. This transformation takes place under the influence of the caseasis; that is to say, of the ferment produced, according to Duclaux, by the bacteria on the one hand and the lactic acid on the other. We furthermore find in kephir, even when well prepared, traces of butyric and succinic acids as well as of other impurities, the quantity of which increases to an undesirable extent when the kephir goes bad.

When kephir fermentation proceeds properly it should take place at a fairly low temperature, not over  $15^{\circ}$  to  $20^{\circ}$  C. It is facilitated and accelerated by suitable shaking of the milk. In this way is obtained the liquid that I now show you, that is kept in air-tight recipients. Owing to its richness in  $\text{CO}_2$  it foams. It is seen to hold fine particles in suspension, but it should contain neither clots nor lumps of any appreciable size. Its taste is somewhat sour, on which account many, if not all, patients find it pleasant to take.

Kephir differs very noticeably from the cow's milk from which it is prepared. As regards its value as a food-stuff, it represents milk that is undergoing digestion, which digestion develops in its elements more easily assimilated than those of milk and more suitable for final digestion. These peculiarities alone already give it the character of a remedy; but it acquires this character entirely when we consider its high tenor in  $\text{CO}_2$ , in lactic acid, and, we can add, in alcohol, although the latter substance is only present in very slight proportions.

You know that there are three varieties of kephir: (1) Weak kephir, that has fermented for 24 hours; (2) Ordinary kephir, that has fermented for 48 hours; and (3) Strong kephir, that has fermented for 72 hours. The difference between these preparations and cow's milk consists not so much in their tenor in casein and albumin, which are the usual products of milk, but in the presence of acid-albumin, syntonin, and peptones. They contain less lactose than milk, owing to the presence of lactic acid in large proportions, its percentage reaching 7, 8, or 11 grams per liter, according to the variety. Alcohol, finally, is only present in small quantities, not more than one gram per liter at the most.

Turning now to the physiologic action of kephir, let us first see what new properties result from the presence of elements that are foreign to ordinary milk.

The most important of these elements from a therapeutic point of view is probably the lactic acid. You know that the digestive tract contains small quantities of this substance even in a normal state. It appears at the beginning of digestion, and in pathologic cases often attains large proportions. Next to HCl it takes a leading part among the organic acids of the stomach, and we might say that a lactic form of digestion is possible just as a chlorhydropeptic one is. Langaart has shown that even diluted to one in twenty it completely dissolves the casein of both woman's and mare's milk.

During normal digestion it is the lab-ferment, or rennet, that precipitates the casein; in koumiss and kephir this precipitation takes place outside of the stomach under the influence of the lactic acid. As was shown by Schmidt, of Dorpat, in the former case the product consists in large, elastic, firm, and not very soluble clots, and it is in this form that they are found when patients vomit milk during the course of digestion; in the second case the casein is precipitated in the form of small flakes, soft to the touch, glairy, easily dissolved in alkaline carbonates, a portion of which precipitated casein is, in kephir, already partially redissolved. This is why I told you that kephir is milk partially digested, as these different processes have already taken place in the kephir before it reaches the stomach.

But in addition to this digestive action, lactic acid has other properties. It can pass into the circulation in the form of lactates, which will be eliminated by the urine as alkaline carbonates.

Before absorption it passes along the intestinal tract; while there it has a microbicidal action, not very great, it is true, but still perceptible. Now you know that I use lactic acid to advantage in certain forms of toxic infectious diarrhoea, such as that of typhoid fever, as well as in other varieties of diarrhea in children and grown persons. For kephir has in certain cases a remarkable action on diarrhea, due, in part, to this acid.

Owing to its tenor in CO<sub>2</sub>, kephir may be considered as having a certain anesthetic effect; thus it is capable of diminishing gastric hyperexcitability. We also believe that to this cause it owes its property of stimulating contraction of the unstriated fibers of the stomach and intestine.

There is in kephir a very small amount of alcohol, which seems

almost insignificant from a therapeutic point of view; yet it may be to this that it owes its property of being a stimulating drink. Certain nervous and excitable patients experience a sensation of intoxication after a single glass of kephir, but this is attributable to the  $\text{CO}_2$ .

The majority of writers look on kephir as a food, and as such it has been used by certain peoples for centuries. On account of this use the Russian physicians, whose merit it has been to introduce kephir into therapeutics, look on it as a means of stimulating nutrition and of over-feeding. This opinion has been accepted by the greater number of physicians, so that the kephir treatment is resorted to in complaints in which it is desired to increase the patient's weight, and particularly in tuberculosis. But this idea of considering kephir as merely a restorative food is one that is perhaps not altogether accurate, and at any rate that is singularly narrow.

The true normal food of that kind is natural fresh milk, and nothing goes to show that it can be replaced without harm or even to advantage by koumiss or kephir, forms of food, if not spoiled, at any rate deeply modified. In this connection the Russian physicians have not furnished us with much information. We should like to know how its use is stood by the tribes that consume it habitually, and whether it does not give rise to more or less marked pathologic disorders. The Russian writers simply say that the poorer people of the Caucasus who live on kephir have coated tongues and gastric trouble, particularly pyrosis; but they think that these disturbances, which occur particularly in summer, are due, not to the kephir itself, but to the dirty manner of its preparation which exposes it to accessory fermentation, butyric, acetic, etc.

The use of kephir, therefore, seems to present no very great risk in adults; but does this hold true as regards children? The tribes that use kephir give the breast to their children for a relatively long period. This is very fortunate, as it seems probable that if they brought them up on kephir they would expose them to the ravages of rhachitis.

In short, although it is true that kephir is a food, and even a remarkable one, it does not seem to me to possess in this respect any advantage over milk, and there are reasons for suspecting that

from the point of view of alimentary hygiene, considered at the different ages, it is not altogether devoid of drawbacks.

If, now, however, we consider kephir from the point of view of a food for sick people, we see that without question it is in certain pathologic conditions much superior to ordinary milk. Its value even as a food is related to the disease; we must, therefore, not accept, with Podwyssotzky, the following proposition: "Its therapeutic action is due to its value as a food." I have endeavored, on the contrary, to demonstrate that kephir is a real *remedy*, a food-remedy, if you wish, but an active and remarkable remedy, and as such presenting indications and contraindications.

Since the time in 1880 when kephir began to be so highly spoken of in Russia as a successor to koumiss in the treatment of phthisis, its use has extended to all lands. It was found to act favorably in tuberculosis, serious forms of anemia, certain cases of venous portal stasis, some cachectic conditions, etc. But few physicians paid any attention to its indications in disorders of the digestive tract. It is this side of the question, the most interesting one in my judgment, that has formed the object of my researches.

This, gentlemen, is the usual way in which things occur. A very capable brother physician called me in consultation about an elderly dyspeptic lady in whose case every kind of treatment has been employed to no purpose. I found a woman greatly reduced in flesh, suffering from severe dyspepsia of a hypopeptic form, aggravated by long-continued administration of drugs. I prescribed kephir, and in a few months' time her physician found very great improvement in her condition. Seized with enthusiasm by this result, he immediately, without further consideration, proceeded to apply the same treatment to an elderly dyspeptic man in a cachectic condition, with whom it gave no result at all. And it is in this happy-go-lucky manner that the best of remedies are prescribed, instead of seeking carefully for their indications. You have heard me say on many an occasion that the physicians who despise the use of methods of examination that reveal the way in which the stomach accomplishes its function were mere empirics. They may chance on a good result with kephir now and then, but will never be able to prescribe this valuable substance with certainty.

In order to facilitate the study of the cases in which kephir can be prescribed, we shall group them into a small number of principal categories.

Let me, in the first place, draw your attention to the gastric disorders characterized by intense hypopepsia, or even apepsia, with slight secretion and rapid evacuation, sometimes already completed one hour after taking the test meal.

Cases such as these, which are far from uncommon, are certainly those in which the kephir treatment gives the best results, which are specially noticeable when the patients are exhausted by a combination of a gastric complaint with a more or less marked condition of diarrhea. In some of these instances we can speak of the kephir having resurrected the patient, without in any sense using hyperbole.

The modifications produced by this treatment in the working of the stomach, depend on the variety of gastric lesion having given rise to the chemical type against which you have directed the treatment.

When the hypopepsia, or apepsia, is the result of a superposed irritation,—that is to say, of the superposition to a gastritis of pathologic origin, of an inflammation set up by the use of irritating drugs,—a condition that occurs in practice with lamentable frequency,—it is customary to see the kephir treatment stimulate the secretion, render digestion more pronounced and at the same time more gradual, and bring to prominence again a condition of dilatation that had existed in an earlier phase of the disorder. It is not uncommon, under such circumstances, to see the hypopeptic or apeptic type be replaced by a form that is manifestly hyperpeptic.

Are we to infer from this that the kephir treatment produces hyperchlorhydria, as has been stated by certain physicians who have witnessed this occurrence?

I have proposed for these interesting cases an explanation that it is well for you to remember. My anatomo-pathologic researches enable me to believe that hypopepsia and apepsia of toxic, and especially of drug origin, are the result either of lymphoid and leukocytic infiltrations or of cellular degeneration. In some instances the lesions are curable, at any rate in part, and when they are superposed to a parenchymatous gastritis pure and simple, any

treatment capable of lessening or of doing away with them altogether ought to bring forth again a hyperpeptic type.

This is what takes place in these circumstances under the influence of the kephir treatment, which, so far from being harmful, produces real improvement by simplifying the gastric lesion. The disorder retraces its steps, so to speak, and this is the manner in which it ought logically to proceed before it can be usefully modified by an appropriate treatment, the dialytic medication whose principles I have made known to you.

With this first category of cases I may associate those in which a hypopeptic or apeptic condition is combined with sluggish evacuation due to myelasthenia, with or without muscular atrophy. These patients' secretion is weak and not abundant, and yet their stomachs empty themselves slowly owing to the condition of the muscle. The use of kephir is indicated in these cases also and will give good results, but on the express condition that the amount taken should be so arranged, as also that of the rest of the food, that all suspicion of overfeeding shall be avoided. The manner in which the remedy is used acquires in this instance great importance.

In a third group we can place the patients suffering from gastric disorder characterized by more or less severe hyperpepsia, with manifestly weak secretion, much below the normal, and consequently with early gastric evacuation. These patients are generally treated with alkalies, even and especially by physicians with a sufficient degree of inquisitiveness to examine the composition of the gastric juice. They are generally cases of long-standing dyspepsia with complex anatomic alterations of the gastric mucous membrane, and frequently with mixed parenchymatous gastritis in process of atrophy. The use of kephir is clearly indicated in such cases and will produce excellent results. But they have to be watched, for when the decrease in secretion is the result of a superposed irritation capable of being dissipated, the secretion increases and the hyperpepsia may assume the form under which it usually appears and be accompanied by prolonged digestion. This is the moment to interrupt the use of kephir and to intervene by means of the dialytic treatment. But it is not very unusual to find that the type of digestion that we are now considering is the result of gastritis tending toward complete atrophy, and that after



more or less prolonged kephir treatment a hypopeptic or even apeptic type appears. This is one more proof to show that the effects of kephir vary according to the organopathic conditions in which the remedy is used.

In the fourth category we will place cancer patients. The use of kephir even at an advanced stage of the disease gives remarkable results. Still it is necessary, in order that the kephir may be tolerated in sufficient amounts to improve nutrition, that gastric evacuation should be complete; in other words, that there should be no stenosis. The indication for kephir occurs therefore chiefly in diffuse cancer where there is no considerable obstruction to the flow of the gastric contents.

With certain patients already cachectic, exhausted by emesis or by the impossibility of nourishing themselves, the kephir treatment can effect such a degree of improvement that the accuracy of the diagnosis may be called into question.

The fifth category contains the patients who have become cachectic through some serious chronic disorder, tuberculosis, symptomatic anemia, kidney disease, liver complaint, etc. We have now reached the field of current practice. These are the cases in which all writers see in kephir a food of easy digestion or a means of high-pressure feeding.

The indication drawn from these conditions is no doubt a very evident one, but it really depends altogether on the gastric type of the patients. It is necessary, for the kephir to be well tolerated and useful, that the type should come under one of the preceding categories. Thus, no kephir should be prescribed for hyperpeptic tubercular patients, whereas it can be given with advantage to such as are hypopeptic or atonic.

In this way I am brought to the subject of the contraindications of kephir.

There are, gentlemen, two leading contraindications to the use of kephir. I set aside the distaste that some patients have for this substance; it is unusual for patients suffering from a complaint that can be benefited by kephir to show any aversion to it. On the contrary, we frequently find patients with a strong liking for kephir, continuing to use it for their own pleasure, although their condition of health would enable them to get along without it.

You will encounter the first real contraindication in hyperpeptic patients with abundant secretion and slow gastric evacuation. These are cases of dilatation the result of prolonged digestion. Give no kephir to such patients, as it would prolong the duration of their digestion, retard the evacuation of their stomach, and in consequence increase their dilatation. Kephir is likewise contraindicated in the ordinary case of gastric ulcer, in which it is habitual to find a hyperpeptic type with abundant secretion. It can only be prescribed in ulcer cases in those rare instances, in which with long-standing lesions there is little secretion.

The second contraindication is more imperative still: the existence of pyloric stenosis preventing the passage of food from the stomach into the intestine. When imprisoned in the stomach the kephir continues to ferment and produces in the entire gastric contents accessory fermentation, butyric and acetic, which soon makes the digestive disorder worse.

We are now in a position to give in a simple formula the general indication for kephir, and may say, to sum up the question, that this substance is specially adapted for all patients suffering from insufficient gastric functions, and particularly from insufficient secretion. It supplies them, so to speak, with lactic digestion, which takes the place of the absent gastric fermentation. This is the key to the therapeutic use of kephir. The results of my experience are, as you see, manifestly clearer, if not more scientific, than those of the writers who see in kephir nothing but a restorative food. In my view, the kephir treatment is, above all things, the treatment of insufficient secretion of the stomach, of glandular atrophy, and in many cases also the best for myelasthenia with or without muscular atrophy.

The way of taking kephir depends naturally on the conception one has of its indications.

In accordance with their ideas, foreign writers say that kephir is a food of which patients should take the greatest quantity possible, as it only acts in large doses. In this way the Russian physicians get their patients to take as much as fifteen to twenty glasses of kephir per diem, together with other food; kephir with them is only another means of high-pressure feeding.

My conception is, as I have told you, quite different, and I am in the habit of prescribing kephir, a food-remedy, in two ways:

Either I give an entire kephir treatment, just as one would an absolute diet, or I have recourse to a mixed treatment.

It is not very often that I give an absolute kephir treatment; at least, I only do so temporarily, as I look on it as a preparatory treatment that I only keep up a few weeks. At the start I only give five or six glasses a day, at regular intervals, which amount I increase gradually to a maximum of ten or twelve glasses. This integral kephir treatment is indicated in cases of hypopepsia or apepsia with intense diarrhea, in which it gives remarkable and rapid results. It is likewise indicated in certain cases of cancer accompanied by gastric intolerance and vomiting persisting in spite of a milk diet. It is also to be advised in tuberculosis with diarrhea when the patients are of a hypopeptic type and their gastric secretion is rather diminished than increased.

You should endeavor whenever possible to introduce into the diet solid food—soft-boiled eggs, scraped raw meat, pulped cooked meat, mashed vegetables, alimentary pastes, bread, etc. Kephir then only acts as a drink, and in this way is constituted the mixed cure, which can frequently be prescribed from the start. The patients have three meals a day, using a certain amount of kephir as their only drink. I generally give a glass and a half of kephir per meal, sometimes two. When there is a fair appetite and the stomach empties itself properly between lunch and dinner, I let the patient take toward four or five o'clock another glass of kephir, making four or five glasses a day. This mixed diet is almost always sufficient, and you should only prolong the integral treatment in cases of intense gastric intolerance with certain cancer cases.

There is a final practical detail to which I call your attention. You know that kephir No. 1 is slightly laxative, whereas No. 3 constipates. This is a fact that you must take into account in prescribing an integral kephir treatment, but which loses most of its importance in the mixed diet. As a usual thing, I prescribe No. 2, which is the most agreeable to take as well as sufficiently active therapeutically. By its use I have been able to regulate the bowels in both constipation and diarrhea by simply straightening out the working of the stomach.

Although desirous that this lecture should be essentially a practical one, I cannot refrain from saying at its close what I think as regards the way in which kephir acts. Some physicians look on

it as a stimulator of the gastric functions because through its use we see gastric secretion begin again after being suppressed for long periods. For my part I look on kephir as the chief anti-phlogistic form of food.

You know that every inflamed organ ought to be left at rest, either absolutely or relatively. But it is impossible to put a stomach at rest if we continue to nourish the patient by the mouth. Kephir is the only food that enables us practically to attain our purpose under the conditions mentioned. A patient whose stomach is irritated and intolerant perceives this action and says that the kephir is soothing; and you will find that in this respect it is superior to milk, whose digestion requires greater effort.

It is to this sedative action that the changes observed in the chemical type of digestion after a kephir treatment are to be referred. They all depend on a simplification of the anatomic lesion, and on the disappearance of superposed irritation due to bad alimentary hygiene or to the use of irritating drugs. To it should also be attributed the cessation of certain nervous disorders, caused, kept up, and made worse by local sources of irritation.

In the second place, kephir should be looked on as a disinfectant. Owing to the large amount of lactic acid it contains, it has a species of antiseptic action on the different portions of the digestive tract, and particularly on the intestine. But we must also take into account its tenor in yeasts and inquire whether, by multiplying in the digestive tract, these yeasts are not capable of having an inhibitory effect on the development of microbes. We know that of late years real therapeutic properties have been attributed to different yeasts, and particularly to those developing in kephir, properties that seem to be connected with this preventive effect on intestinal fermentation. Ten years ago, at a time when nothing had yet been said about these therapeutic agents, I was very much struck by the disappearance of a stubborn form of acne in the case of an apeptic patient on the kephir treatment. Since that time I have looked on kephir as a useful agent in cutaneous complaints of gastro-intestinal origin. It would be interesting to continue the study of its action in such cases, and to try and ascertain the value of yeasts in this variety of therapeutic action.

From the special point of view in which we have placed ourselves to-day, the calming, sedative action of kephir is the one that

ought particularly to attract your attention; but I wish you to note that this alone cannot explain all the gastro-intestinal effects of kephir.

There is one that is very important, rapid improvement in the entire digestion. When gastric digestion is inadequate, the intestine takes its place, and alone, so to speak, renders fit for absorption and assimilation the alimentary bolus. When for different reasons this supplementary action of the intestine only takes place partially, the patients sink into a serious condition of total dyspepsia. Now, kephir remedies this pathologic disorder with singular efficacy, probably because it represents, I repeat it once more, a food already partially digested, similar to what enters the intestine under normal circumstances to be the object of the final digestion.

## **SOME OBSERVATIONS ON THE TREATMENT OF PULMONARY HEMORRHAGE BY ADRENALIN CHLORID**

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THE drugs which, from time to time, have been advanced as "cures" in the treatment of pulmonary hemorrhage and have proved worthless are very numerous. Apart from the difficulty of obtaining a drug which satisfies the conditions necessary to bring about an arrest of such a hemorrhage, there is the further great difficulty of estimating scientifically its true effects. It is but right that we should look to pharmacology and physiology to test our remedies before applying them to the treatment of disease in human subject; but, nevertheless, it cannot be said that those drugs which have by physiologic experiments on the lower animals been regarded as satisfying the theoretical requirements in the treatment of pulmonary hemorrhage, have proved at all satisfactory.

As adrenalin chlorid has lately been brought to our notice as a highly successful hemostatic and is being used in the treatment of pulmonary hemorrhage, I have been led to make some observations on its action in this connection. It is for us to find out if it can satisfy the physiologic and pharmacologic conditions necessary to bring about an arrest of the pulmonary hemorrhage, and even if it does not, to ascertain if clinical observations on the human subject warrant us advocating its use.

In the first place, let us review its physiologic and pharmacologic actions as far as is at present known.

**EVIDENCE FROM PHYSIOLOGIC EXPERIMENTS ON THE LOWER ANIMALS.**—According to the method of administration, we get a different outstanding effect. It may be said that the outstanding effect produced by subcutaneous injection is an increase in the rapidity of the respiration, and that by the intravenous method a slowing of the heart's action. In rabbits and dogs by both subcutaneous and intravenous injection, glycosuria is a usual result. By both the latter methods of administration we get, with fairly small doses, a

distinct increase in the systemic blood-pressure, but when it is given by the mouth it is held that it has no such effect and no glycosuria is produced. It is also to be noted that there is a distinct difference in the rapidity of its action, according to the method of administration—the intravenous method being the most rapid, while that by the mouth is the least so.

*Action on the Heart.*—Experiments on the lower animals tend to show that if adrenalin chlorid is injected subcutaneously we get a distinct acceleration and augmentation of the heart's action, according to the dose. If it is administered intravenously, the effect is to produce a slowing and yet an augmentation of the heart's action, but if it is given by the mouth there is no evidence to show that it is affected in any special way.

*Action on the Blood-Vessels.*—If it is injected subcutaneously or intravenously, it gives rise to a constriction of the peripheral vessels of the systemic blood system, leading to an increase in the systemic blood-pressure. When it is administered by the mouth, it is held that this action is very slight if at all present, and this point must be carefully noted as having a special bearing on the subsequent discussion.

Oliver and Schäfer<sup>1</sup> hold the view that adrenalin chlorid acts on the smooth muscle fibers of the blood-vessel in bringing about its constriction. Dixon and Brodie,<sup>2</sup> however, maintain that it acts on the blood-vessels through their vasomotor system, and state that the pulmonary blood-vessels do not possess any vasomotor nerves, thereby accounting for their non-constriction or dilatation when adrenalin is injected through them.

Dixon and Brodie's<sup>3</sup> observations would lead us to believe, that adrenalin chlorid when injected into the pulmonary blood-vessels generally gives rise to their dilatation and not constriction as in the case of the systemic peripheral blood-vessels. As so much depends upon its effect on the systemic, and especially on the pulmonary blood-pressure, it is necessary for us to inquire into the different conditions affecting them.

Bradford and Dean<sup>4</sup> believe that the pulmonary vascular sys-

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<sup>1</sup> Journ. Physiol., vol. xviii, page 230, 1895.

<sup>2</sup> Ibid., Feb. 25, 1904.

<sup>3</sup> Ibid., vol. xvi, page 34, 1894.

<sup>4</sup> Ibid.

tem does possess a vasomotor mechanism, but hold that it is poorly developed in comparison with that of the systemic system. Whatever view is the correct one, at present one is inclined to accept the observation made by Dixon and Brodie, that adrenalin chlorid when injected into the pulmonary vessels generally leads to their dilatation, whatever the explanation may be. It follows from this, that if we usually get a rise in the systemic blood-pressure, and a non-constriction or dilatation of the pulmonary blood-vessels, the chances are all in favor of a rise in the blood-pressure of the pulmonary vascular system. Even although we admit that the systemic and pulmonary blood-systems are comparatively independent, if we have an acceleration and augmentation of the heart's action giving rise to an increased output of blood from the left ventricle, and also a dilatation of the pulmonary arterioles, everything points to a damming back of the blood in the left auricle, pulmonary veins and arterioles, as a consequence of the secondary effect of a decreased output of blood from the left ventricle owing to the peripheral systemic constriction.

As far as can be deduced from experiments on the lower animals, we may reasonably conclude that adrenalin chlorid when injected subcutaneously, accelerates and augments the heart's action, raises the systemic blood-pressure, increases the rapidity of the respiration, leads to the production of glycosuria, and in all probability to a distinct rise of the pulmonary blood-pressure. When the drug is administered by the mouth its action is very much slower, its effect on the systemic blood-pressure very slight if it has any at all, and there is no production of glycosuria.

From the physiologic stand-point these conclusions do not hold out any great hope that adrenalin chlorid would be of much use to us in the treatment of pulmonary hemorrhage.

**CLINICAL EVIDENCE.**—As I have already stated, it is very difficult to obtain an accurate estimate of the effects of any drug used in the treatment of hemoptysis. The main points we wish to determine are, the effect of adrenalin on the pulmonary blood-vessels and on the blood-pressure in the pulmonary vascular system. It must not be imagined that because the pulmonary hemorrhage ceases soon after the administration of any remedy, that this result has necessarily been due to its action. Nevertheless, it is of special interest to obtain the records of the progress in cases of pulmonary hemorrhage where adrenalin chlorid has been tried.



Within the past few years, while working as house physician at the Brompton Hospital for Consumption, the Edinburgh Royal Infirmary, the Royal National Hospital for Diseases of the Chest, Ventnor, and as physician to the Sanatorium, Banchory, I have had occasion to watch carefully the results of the treatment of pulmonary hemorrhage by adrenalin chlorid in 16 cases of chronic pulmonary tuberculosis. In 15 of these it was administered by the mouth and in one by subcutaneous injection. The dose in all the 15 cases was 10 minims every two hours for 4 doses, and then 10 minims four times daily for the three days following. The hemoptysis was very profuse in four of these cases, and in the others, of moderate severity.

When given by the mouth, as far as I could judge from careful observation, the drug seemed to have little effect on the systemic blood-pressure, and also on the rate of the pulse and respiration. As far as the characters of the aortic and pulmonary valvular sounds were concerned, although after the administration of the various doses the loudness of both first sounds was slightly increased, there were none of those characteristics of the second sounds noted which are to be described later in connection with the subcutaneous injection of the drug. In all the cases the hemorrhage ceased after the first day except in four, and in these it continued at intervals for from five to seven days. Within six months there was no recurrence except in three cases. It was impossible to get a satisfactory and accurate estimate of the effects of this remedy when given by the mouth, because of the tendency in the majority of these cases to undergo a natural rest.

I have now to record the observations made in the case of severe hemoptysis which I treated by the subcutaneous injection of adrenalin chlorid (1 in 1000), and here I was able to obtain a more accurate estimate as to its effects. The patient who suffered from chronic pulmonary tuberculosis had been subject for some time, at intervals of three or four months, to severe attacks of hemoptysis which had recurred in spite of rigorous treatment by various remedies. The disease affected the upper, middle, and lower lobes of the right lung, and there was evidence of an old-standing, small contracted cavity in the upper lobe. The case was unique in that the patient generally knew when an attack was coming on, and when it occurred, he was very composed. Hence one was able to make

fairly accurate observations of his condition. The treatment, which was carried out with the patient's approval, and the methods of observation were as follows. Previous to the hemoptysis, a record was obtained of the patient's general condition, heart, pulse, and respiration. Sphygmographic tracings were taken of the pulse, and the characters of the aortic and pulmonary valvular sounds carefully noted. A severe hemoptysis occurring one day at 1.15 P.M., a subcutaneous injection of 10 minims of adrenalin chlorid (1 in 1000) was given at 1.30 P.M. This was followed at 5 P.M., 8.15 P.M., and 10.15 P.M. by injections of 5 minims each. On the second day four injections of 5 minims each were given, at 10.15 A.M., 2.25 P.M., 6.15 P.M., and 10.15 P.M. On the third day three injections of 5 minims each, at 10.15 A.M., 3.10 P.M., and 7.10 P.M.; on the fourth day two injections of 5 minims each, at 10 A.M. and 2 P.M., and on the fifth, sixth, seventh, eighth and ninth days one injection of 5 minims daily were given. The effect of these injections on the general condition, heart, pulse, and respiration, were carefully estimated. With regard to the pulse, its rate, rhythm, volume, and tension were noted, sphygmographic tracings being taken immediately before each injection, and at intervals of  $\frac{1}{2}$  hour,  $\frac{3}{4}$  hour, 1 hour,  $1\frac{1}{2}$  hours, 2 hours, 3 hours, and 4 hours after it—35 tracings in all being taken (Figs. 1 and 2). The rate and quality of the respiration were also recorded, and particular attention was paid to the individual and also the relative characteristics of the aortic and pulmonary valvular sounds. The following were the results:

Fifteen minutes after the first injection of 10 minims the patient experienced an extreme sensation of constriction in the chest which he had never felt in any of his former attacks. This passed off in about 20 minutes, and after none of the subsequent injections of 5 minims each did he experience any such effect.

About fifteen minutes after the first injection of 10 minims the aortic second sound was distinctly accentuated. On auscultating over the pulmonary area at the same time, there was no such accentuation of the pulmonary second sound. On examining over the aortic and pulmonary areas about a half-hour or so after the injection, the observation was made that the pulmonary second sound was relatively more accentuated than the aortic second sound. This relationship between the aortic and pulmonary second sounds was maintained for at least 2 hours afterward.

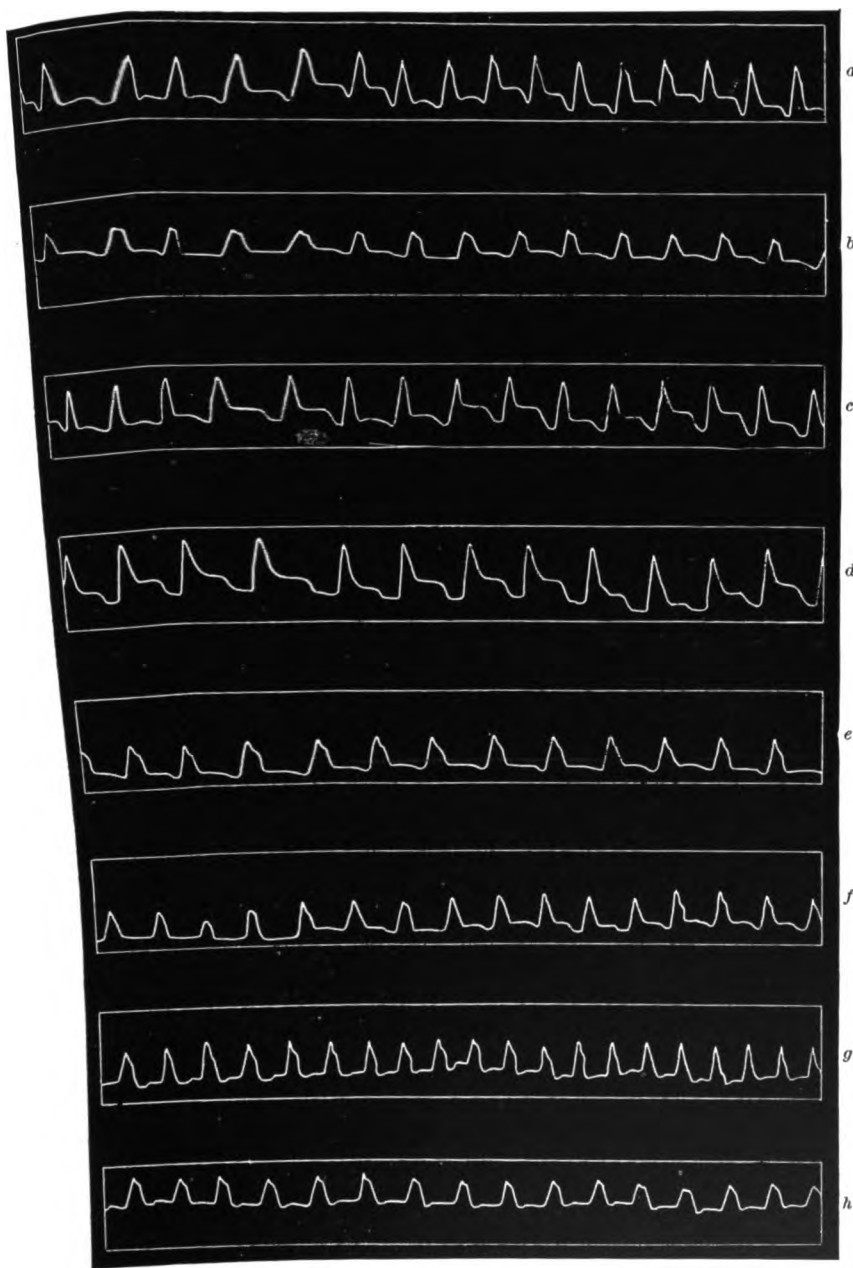


FIG. 1.—Sphygmographic tracings of the left radial artery, showing the effects of the subcutaneous injection of adrenalin chlorid in severe hemoptysis occurring in a patient with chronic pulmonary tuberculosis. *a.* Tracing taken before the hemoptysis; pulse-rate, 94. *b.* One hour after the injection of 10 minims of adrenalin chlorid, 2.30 P. M.; pulse-rate, 112. *c.* Three hours after the first injection, 4.30 P. M.; pulse-rate, 108. *d.* Just before the eighth injection (5 minims) on the third day, 10 A. M.; pulse-rate, 98. *e.* One hour after the eighth injection, 11 A. M.; pulse-rate, 110. *f.* Five hours after the eighth injection and just before the ninth injection (5 minims), 3 P. M.; pulse-rate, 106. *g.* One-half hour after the ninth injection, 3.40 P. M.; pulse-rate, 118. *h.* Two hours after the ninth injection, 5.10 P. M.; pulse-rate, 112.

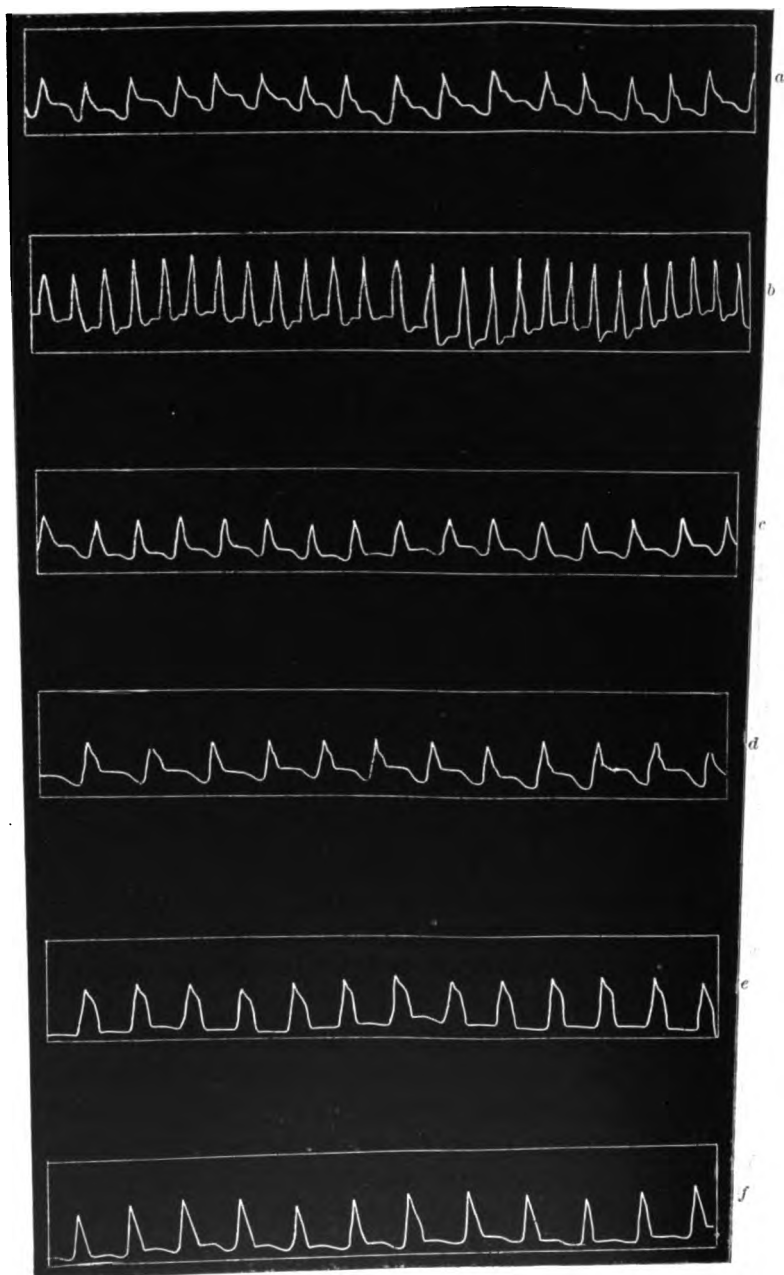


FIG. 2.—Sphygmographic tracings of the left radial artery, showing an unusual effect of the subcutaneous injection of adrenalin chlorid in severe hemoptysis occurring in a patient with chronic pulmonary tuberculosis. *a.* Tracing taken just before the fourth injection (5 minims) 10 A. M. : pulse-rate, 102. *b.* Three-quarters of an hour after the fourth injection, 11 A. M. : pulse-rate, 128. *c.* Two and one-quarter hours after the fourth injection, 12.30 P. M. : pulse-rate, 110. *d.* Four hours after the fourth injection, and just before the fifth injection (5 minims), 2.15 P. M. : pulse-rate, 104. *e.* One and a quarter hours after the fifth injection, 3.45 P. M. : pulse-rate, 112. Three and a half hours after the fifth injection, 6 P. M. : pulse-rate, 104.

After the injections, as far as could be judged by the finger and the sphygmographic tracings, the rate of the pulse was usually increased from 10 to 12 beats, and the tension was always increased, except in one instance (Fig. 2). There was no irregularity of the pulse produced. It was specially noted that the pulse tracings taken at 10 A.M. after the night's rest always showed a return to their normal type. Soon after the injections were discontinued the rate of the pulse fell 8 to 12 beats, and the sphygmographic tracings assumed the same characters as those taken before the injections were begun.

The maximum effect of any given injection seemed to be reached usually about three-quarters of an hour afterward, and its action to some extent was still apparent for about 4 hours after the injection, as far as one could judge.

As a result of the injections, no bad local effects were produced, as has been recorded by some observers.

During the treatment the patient had one or two very slight hemorrhages, but a fortnight after the injections were discontinued he had another very severe attack.

#### CONCLUSIONS

We might conclude, that any drug which is to effect the arrest of the pulmonary hemorrhage must act, either by bringing about certain conditions in the circulatory system which lead to the coagulation of the blood and subsequent formation of blood-clot at the site of the hemorrhage, or must give rise to conditions which lower the pressure in the pulmonary blood system. We have no evidence for supposing that adrenalin chlorid hastens the coagulation of the blood, in fact everything points to an effect in the opposite direction. With regard to the great question as to its effect on the pressure in the pulmonary blood system, if we accept the observations of Dixon and Brodie already quoted, we must conclude, that as a result of its subcutaneous injection, we get a great accumulation of blood in that system; this is brought about by an increased initial output of blood from the left ventricle of the heart, and after a short period a diminished output, leading to a damming back of the blood in the left auricle, pulmonary veins, and arterioles. The result of this would be a tendency to an increase in the pulmonary hemorrhage. If we grant that the drug constricts the pulmonary arteri-

oles, then we might suppose that as long as its action lasted the pulmonary hemorrhage would be controlled. In this connection, however, we must take into account the morbid state of the blood-vessels of the lung in which the hemorrhage usually occurs, and also that its action is only transitory, which is explained by the fact that in the presence of alkalies and oxygen it is changed into inert oxy-adrenalin.

In the case treated by subcutaneous injection which I have described, I have recorded the interesting observation, that after each of the injections the pulmonary second sound was not relatively accentuated as was the case with the aortic second sound, until sometime after the accentuation of the latter. This, I think, supports the view of Dixon and Brodie with regard to the non-constriction of the pulmonary arterioles, because I hold, that if these had been constricted along with the systemic arterioles, the initial acceleration and augmentation of the right ventricle would have brought about a great increase in the blood-pressure of the pulmonary artery and an early accentuation of the pulmonary second sound. As far as the administration of adrenalin chlorid by the mouth is concerned, although the effects are not nearly so marked as in the case of subcutaneous injection, they are identical. It is also to be noted in this connection, that as a rule the doses usually prescribed by the mouth are quite inert as far as any action on the pulmonary blood system is concerned, and this accounts for a large proportion of the cases of hemoptysis which are reported as having been "cured" by the administration of adrenalin chloride, the fact being, that in all probability the hemorrhage in these cases had undergone a natural arrest, even in spite of its administration.

That this drug might be of service in bringing about an arrest of hemorrhage from the bronchial vessels (that is, in early cases of pulmonary tuberculosis) might be reasonably expected. When it is administered by the mouth, its constipating effect, as in the case of ergot, must not be lost sight of.

In conclusion, I may say that everything leads me to believe that adrenalin chlorid is contraindicated in the treatment of pulmonary hemorrhage.

I have to record my indebtedness to Professor Schäfer, Professor T. G. Brodie, and Dr. W. E. Dixon, for much kind help in connection with this paper.

## SUGGESTIONS REGARDING THE TREATMENT OF NEURASTHENIA

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IN a former article<sup>1</sup> I spoke of what measure of success we have a right to expect when we undertake the cure of neurasthenia, namely, placing the nervous centers in a condition to provide the amount of force which they were originally intended to develop, to do the most work they are capable of without waste or distress. It is not to be expected that an originally feeble nervous system can be very greatly strengthened when the defect is hereditary, congenital, or acquired at a very early age from unfortunate influences in the home or school, or that any amount of treatment will enable the patient rashly to overstep the limitations marked out by experience.

Although it is interesting and important from many other points of view, in particular that of prognosis, to make a sharp distinction among the various conditions to which the name neurasthenia is often so loosely applied, it is quite as much so in regard to therapeutics, for, although many of the measures usually employed in the genuine affection are likely to do good also in others, yet there are some, notably pseudo-neurasthenia, laziness, timidity, or hysteria, in which, if put rigorously in force, they may result in confirming rather than relieving the symptoms or at best in postponing the use of something more efficient.

Neurasthenia, while not, as it seems to me, simply an extreme fatigue of the higher centers, is undoubtedly closely related to and dependent upon it. It may be considered a fatigue which has gone so far as to produce a paresis of the attention and will, as shown by the inability to hold any subjects, or subjects of a certain kind, for any considerable time in the mind and act upon them without mental and physical distress. The distinction is somewhat like that between an ordinary fatigue of a muscle from work and the paralysis which may result from extreme and long-continued extension.

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<sup>1</sup> INTERNATIONAL CLINICS, Fourteenth Series, 1904, vol. i, p. 26.  
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Hence the treatment of neurasthenia, although indeed based upon the relief of fatigue, demands also restoration of the power of the nerve centers to store energy as fast as it is expended in function—which is a slower process. If the distinction is not made between fatigue and neurasthenia, the rest cure, pure and simple, will gain the credit for the cure of a more chronic and serious condition than the mere setting right of a temporary want of balance.

Modern practice depends, of course, largely upon the epoch-making work of Weir Mitchell. It is unnecessary to modify what he has written, except, as he himself has done, by making it more adaptable to milder cases and (speaking practically) more limited incomes. The last consideration is not a trivial one, for the “*res angustæ domi*” play no small part in the etiology of many cases of neurasthenia and the formation of a most persistent vicious circle.

But there are several points of consequence in regard to the cause of breakdown and the progress of restoration which are worthy of comment.

An important part in the causation of neurasthenia and other functional affections has been assigned to diseases of the female pelvic viscera, but an estimate of the exact proportion is a matter which depends a good deal upon the point of view of the physician. Before the case is taken in hand solely on the neurologic side, it is much safer that it should be thoroughly examined as to the existence of actual uterine and ovarian lesions and these authoritatively excluded. There is no doubt that a great deal of surgery has been done in this region which is, to say the least, entirely unnecessary, and often much worse.

Sexual excitement, excessive, irregular, incomplete or solitary, may be an element of much consequence in the etiology of various forms of nervous derangement; but it is more than doubtful if it has that controlling force in so large a proportion of cases as has been assigned to it by some foreign observers. When it exists the remedy is simple and easy and the therapeutic result will justify the diagnosis. The usual Anglo-Saxon reticence on such matters should not be allowed to prevent a frank understanding between the patient and physician.

Among the special sources of nervous exhaustion which have been urged with much insistence within the last few years, although distinctly recognized at least since 1872, is eye-strain, in two forms: first, the anisophoria, or want of strength and harmony in action in



the extrinsic muscles, and, second, errors of refraction, largely hypermetropic astigmatism dependent upon originally defective structure of the eyeball, or weakness of the muscles of accommodation. It is interesting to note in passing that the 'phorists and the 'tropists reprobate each other's theories and methods of treatment just as vigorously as they both together do the indifference and incompetence of practitioners who think there may be causes of nervous exhaustion other than eye-strain.

It is unfortunate for arriving at a correct estimate as to the real value of these causes that so much acrimony should have entered into the discussion, and so much doubt have been thrown upon the interest and competency of a large fraction of the ophthalmic specialty, but it is certainly the duty of the neurologist to satisfy himself whether ocular defects may not be the determining cause of the condition he purposes to treat. Dr. Gould proposes as a ready method of diagnosis of the part taken by futile or fatiguing attempts at accommodation, the atropinization of the eye for a few days and observing the amount of relief of the symptoms; but this would hardly satisfy the practitioner who would or should prefer an examination not only to fix the exact diagnosis but to afford the appropriate relief. After all, it is perhaps the extremists who will do more good in actual practice than the men who await the exact truth more philosophically. It is said that Beau Brummell insisted upon his man's blacking the bottoms of his boot soles, since there was no other way of being sure that the edges were properly done.

There are two reasons for beginning the treatment which is popularly known as the rest cure, that is of a patient who is sick enough to come regularly into the hands of the physician for treatment and not merely to be told to take a tonic or to get a vacation. The first of these is that the patient may really need absolute rest for a time, the length of which is one of the difficult points to determine; the other is that the patient may be made to feel that she is not being neglected or urged beyond her strength and that the physician may have her confidence.

Frequent feeding with easily digestible food at short intervals is well understood to form an important part of that treatment. It is also generally admitted that the average person takes considerably more food than he actually needs for the wants of the economy, and that an ordinary diet, if properly digested, contains enough of the chemical elements for repairing all losses to the

system. Barring certain gross errors, a pretty wide range may be given to the diet after the earliest days during which the stomach is coming to its bearings and discovering what it really can take care of. The cook will be of more assistance to the practical physician in practical work than the physiologic chemist. Milk and eggs are likely to be a large part of the exceedingly simple diet of the first days and perhaps some time longer, and a knowledge of as many ways as possible of making milk palatable is a desirable acquisition for the practitioner. The bill of fare, however, should, as soon as possible, be enlarged and not restricted by pure theory.

Special nerve foods, and indeed most of the supposedly highly concentrated foods, are for the most part unnecessary and of very little value in proportion to their price. If used they should be, as indeed they usually are, selected by the taste of the patient rather than by their supposed nutritive value.

In regard to "nerve foods" in particular there is no reason to suppose that any substance which goes to make up brain tissue can be transferred directly from the corresponding organs of any other animal.

Calves' brains (if we wanted them) could not be appropriated as such, but must undergo, like any other food, digestion in the intestinal canal, and then contribute just so much fat and nitrogen as if the elements came from the liver or any other source. Some such foods may contain a little more phosphorus than white flour, but an ordinary mixed diet contains enough for all the functional needs of the economy. This is evident from the fact that in a growing animal such a diet furnishes the phosphates not only for the ordinary consumption, but also for the building up of all the tissues, and in particular the bones; that is, provides not only for running expenses, but also for permanent investment. The administration as such, or in the form of a non-oxidized compound, like phosphid of zinc, has, I think, gone the way of forgotten fads.

If the facts of modern organotherapy appear to contradict these somewhat sweeping statements, it seems to me that we should consider that the extremely interesting and powerful substances which have obtained so firm a hold in therapeutics, of which the most notable example is thyroid extract, are to be placed rather in the category of medicines than of foods. There is no reason to suppose that they contribute any substance to the building up of tissues, but

act as special simulants, or even as antidotes to toxins formed in the body.

Most of the "nerve tonics," and many of the concentrated foods urged upon physicians with such persistency and vigor, are of a highly pernicious character, since they owe their apparently stimulating and strengthening effects to the alcohol they contain. A dose of one of them will produce the same kind, amount, and duration of so-called stimulation as the same quantity of rather poor sherry, over which they possess no advantage, except that one is not so strongly tempted to take too much of them. It is better, if alcohol is to be used at all in the treatment of neurasthenia, that it should be as wine, beer, or some stronger liquor in corresponding dilution, and also that it should be considered strictly a medicine and not a beverage, or left to that discretion which the patient probably does not possess.

Alcohol has undoubtedly played a prominent and disastrous part in the domestic treatment of nervous depression in the early stages, by blunting that sense of fatigue which is nature's safeguard and enabling many a man to keep on in overwork, as he thought, successfully and safely, until a complete breakdown has shown him the insecurity of his trust. The popular notion that a bottle of wine or whiskey is a reservoir of energy which can be liberated in useful form by the vital chemistry is not yet extinct. In fact, speaking of small quantities under certain conditions, this notion rests upon a basis of chemistry and physiology, but dealing with healthy persons who have a liberal and digestible diet, alcohol is a wasteful and dangerous food. Its narcotic effect upon the nervous system far outweighs its rather trivial nutrient value.

Those reformers whose methods must be considered unscientific and unreasonable, however much we may respect their object, who have never allowed to alcohol the slightest sustaining value as an offset to its harmful effects, cannot but rejoice in the results of recent psychologic experiments. The very class of men to whom we have been in the habit of looking as examples of earnest, studious, and profound scientists, whose learning is promoted by copious draughts of beer, are now counting the type set and work done by the moderate alcoholic as against the total abstainer, considerably to the advantage of the latter, and total abstinence is no longer an unknown principle in Germany.

The use of alcohol in disease, and especially in chronic diseases,

has undoubtedly greatly diminished in the course of the last two, perhaps even in the last, generations. It is now recognized as distinctly a nervous depressant.

There is a view, however, which may be taken of this inhibitory paralyzing effect of alcohol upon nervous function which, in connection with the definition of neurasthenia given above, would make its use under certain circumstances admissible, although not in exactly the way nor to the extent which experience has shown to be harmful. If neurasthenia consists in the paresis of the attention and will, so that the mind cannot be held down to its work without distress, and if this condition is the result, as it certainly often is, of an incessant, cramplike, imperative overaction of these functions, so that the mind, distressed or no distress, is unable to free itself even for a short time and for the necessary rest, it is easy to see how the intervention of alcohol, which turns the thoughts in another direction for a time, may have a distinctly beneficial effect, even at the price of a little less work performed within the next few hours. If it is to be regarded as the best condition of mental labor that it should be continuous at the highest level of productivity, alcohol can only lead to relative failure. But this condition is practically impossible for any length of time, except for the most robust intellects, perhaps for no one who is working under the anxious strain which most frequently gives rise to nervous breakdown. Probably, the gift of apparently almost continuous work really lies in the ability to make the rest complete when the time comes. Is not the possibility of bringing about that complete rest by a drug worth the slight loss of power which might ensue from the direct effect of that drug in slightly depressing the mental activity for a few hours?

Of course, if one is able to obtain complete mental rest by laying down his pen or closing his account-books, that is the best way; but this happy faculty is not given to every one, nor is it easy to cultivate. For such as "carry their business to bed with them," or whom black care of any kind pursues day and night, a relief obtained by means which to other persons are dangerous may be better than none.

Such patients are not always sleepless, although, of course, insomnia is a common symptom, but it is quite possible that two or three hours of waking diversion from anxiety and worry may be as

efficient a restorative as sleep from which one awakes immediately into the same mental and emotional atmosphere.

This is admittedly a dangerous doctrine and not to be propounded to other than physicians—and prudent ones at that.

The rest period may find a place in the treatment of both the genuine neurasthenia and the timid, imaginary, or hysteric counterfeit, but in the first it is essential in some form, and in the second may be merely an incident to acquiring a hold upon the patient and a knowledge of the case. In fact, in some cases of the latter kind, its conspicuous absence may be the very means of inspiring that change of the whole mental attitude which is so necessary in all, but in some requires more gradual methods. Sympathy is a powerful remedy, but every physician who has been brought in contact with this class of patients—as who has not?—fully realizes that it is perfectly possible to give too large doses of it and to place it where it will do more harm than good.

In the true neurasthenic the time for making the change from the absolute rest to the active building up requires on the part of the physician the same sort of judgment that the surgeon needs when he decides that the time has come for the fractured joint to be freed from its immobilization and receive passive and, later, active movements. In a case of either kind—that is, when the rest has been continued for a long time, or has been a very temporary treatment, or even when there has been no absolute enforced rest, but the aim has simply been to keep the daily balance upon the gaining side—there are certain general principles which are the same.

Exercises of various kinds are usually and properly employed, but what is not always sufficiently considered is that the mere increase of muscular power is not the object to be aimed at for therapeutic purposes, but the development and strengthening of the psychomotor energy which sets in motion muscular movements. It is desired to bring up to the proper point—that is, the normal point of the individual—the power of attention and will, so that they may act without becoming too rapidly exhausted.

The principle is again akin to that applied in the case of the fracture or the paralyzed limb, which can never be restored to usefulness without encouragement to exercise its functions. The plaster bandage cannot impart strength to the disused muscle, nor can simple feeding and massage do any more for the enfeebled

attention and will, which must have exercise to redevelop them. Here is the fit time and place for an employment,—either an amusement in which the patient can become interested for the sake of the game itself, or, better still, the making and doing of something useful. Then the patient's thoughts are led away from himself and fixed upon his occupation much more effectually than by the admonition,—excellent if it can be carried out,—“Do not allow your thoughts to dwell upon yourself.” He does not keep thinking, as he is very likely to do while taking some exercise in which he cannot get interested, “How shall I feel after this?” but, “Can I make that hole in the next shot?” or “What will this be like after I am done with it?”

A Swiss engineer, Grohmann, has elaborated with German thoroughness the “work cure,” by no means unknown, however, to superintendents of institutions for the insane. He sets forth the advantages and disadvantages for this purpose of different employments in very interesting and instructive remarks.

Hall, of Marblehead, has written a thoughtful paper in which he develops sound views of the nature and treatment of neurasthenia. He has made use in practice of pottery, weaving, and basket-making as handicrafts especially advantageous for his purpose, but the principle is obviously applicable to a vast number of other employments which combine mechanical effort with artistic opportunities.

Out-door sports seem specially indicated, and in many of the lesser cases of threatened neurasthenia have been taken up by the patients themselves. There is no reason why out-door useful avocations should not be also useful—gardening and farming for those who can be interested in them. They certainly afford employment to the rational observer as well as the opportunity for more or less manual labor, as the case may demand.

It is to be remembered, however, that treatment of this kind is to be applied with discretion, and not *ad libitum*. It has often been wisely remarked that no worse advice can be given to a neurasthenic than to tell him to “work it off” by extreme bodily exercise. Such exercise, under pressure and as a distasteful duty, is a mental strain and nervous depressant. It is likely to lead to a worse instead of a better relation between the income and the outgo.

In many institutions it is by no means difficult to find plenty of patients who have tried just that experiment before giving themselves up to a more rational treatment.

## X-RAY TREATMENT OF TINEA TONSURANS

BY DRS. SABOURAUD AND NOIRÉ,

Physicians to Saint Louis Hospital, Paris

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IN 1896, four years after beginning the study of the different kinds of tinea, I expressed the opinion that not only was no known treatment capable of curing tinea tonsurans, but that I felt warranted in predicting that no antiseptic treatment whatever would in the future succeed in accomplishing this object; that although the chemical nature of antiseptics could be varied, their physical power of penetration would hardly be modified; that they would continue to be either solid, liquid, or gaseous, and would always be baffled by the same mechanical obstacle which no one of the means employed, of whatever nature it may have been, had ever succeeded in overcoming. *The roots of the hair are not accessible to external antiseptics.*

For this reason I abandoned all attempts to treat tinea by means of antiseptics and concentrated all my efforts on the endeavor to find some way of arresting temporarily the function of the papilla that produces the hair. During a period of three years experiments were made in my laboratory with microbic toxins that cause the hair to fall, as well as with the thallium salts that have the same effect; but these attempts were abandoned without their having resulted in any practical method of treatment. Radiotherapy, however, was destined to furnish me with the solution of the problem.

A number of physicians had already taken up the question. All who had gone into it had concluded that tinea could be cured or improved by the falling of the hair produced by x-rays. But no one had succeeded in indicating a simple, reliable, and safe method of treating tinea by radiotherapy.

Some of them, in fact all, said that five, six, or even ten x-ray applications to a single patch were necessary, and on this account the treatment ceased to be practical. Others reported that in four or five months' time diseased hairs could be found on the patches treated, and this shows that their method was not a sure one. Still

others met with accidents, radiodermatitis followed by definite cicatricial alopecia.

The part, therefore, that we have taken in this question has been simply to furnish a practical, reliable, and safe method of treating tinea by x-rays. It is superfluous to add that our researches have been facilitated by all the improvements effected in radiotherapy in general by every one who has contributed toward perfecting its technic.

The following is the arrangement of the x-ray apparatus with which we commenced work in August, 1903, and which has not been altered since, except in minor details. A single machine was used until January, 1904, at which period a second was added, and both have been running without interruption ever since. Two current-taps of the usual type are fitted in the electric circuit furnished by the hospital machines for the general lighting. These supply the power for running two small dynamos, each of which transmits its motion to a static machine. One of these machines has ten plates, the other twelve. The electric collectors of each static machine are connected with the two poles of a Chabaud tube, fitted with a Villars osmo-regulator. Finally, on the line of the large circuit is interposed as a short-circuit a Bécélère spintherometer. Every one, nowadays, is familiar with these two apparatuses, the spintherometer and the osmo-regulator, the way in which they work, and their purpose.

At the beginning we were afraid to make use of hard tubes and penetrating rays. But at present this is exactly what we do; we regularly use tubes whose hardness is expressed by a spark of 9 to 10 centimeters; this throws much less strain on the tubes and makes them furnish much more useful work in a given time. Thus, at first our treatments lasted from thirty-five to forty minutes in order to be efficacious; at present they do not last more than seven to fifteen minutes. On each side of the Bécélère spintherometer are the two small Destot and Williams stimulators, which admit of hardening the tube at will, in the same way as heating the osmo-regulator by a Bunsen burner enables you to soften it.

It may be well, also, to refer to a few other minor details in the arrangement of our apparatus. It is known that an entire hemisphere of the tube emits active rays. To counteract the drawbacks that this situation might have for the operator, the tube, mounted



on its Draught centering apparatus, is surrounded with an iron sheath lined on the inside with a layer of ebonite. This sheath is pierced at the end of the tube with a large opening to which can be adapted an entire set of metallic cylinders, all of the same length, and calculated in such a way that their farther extremity which is applied to the patient's head is at 15 centimeters from the anode. These cylinders vary in diameter according to the surface of the scalp to be treated. Furthermore, all these tube accessories, and the metallic guard bearing the cylinder, are fitted horizontally on a transverse rod, movable in every direction around a fixed vertical rod. Joints and screws enable us to place the tube at any height and to send the active portion of the x-rays in any direction.

In this way the operator has under his hand all the parts of the machine he has to use, together with a rheostat to set it going. A single measuring unit is still lacking, one whereby he can judge of the amount of x-rays furnished by the tube during a given time.

In estimating this unknown quantity, Holz knecht's lozenges were first employed. They consist in a mixture of alkaline salts whose color is slowly changed by the action of the x-rays. One of these lozenges is exposed to the rays emitted by the tube and at the same distance as the patient's skin. From time to time the change in the tint of the lozenge is compared with a fixed scale of twelve degrees, of which each unit has been designated by Holz knecht an H. A change in tint corresponding to five degrees on the scale is a maximum that it is never prudent to exceed—at any rate, in a single sitting.

These lozenges had many advantages. To begin with, they supplied a means of measuring that could not otherwise be obtained. In addition to this, their use was neat, simple, and handy. Still, they were not without drawbacks, of which the first, a serious one, was that they were a patented product, and to obtain them we had to rely on a single producer. The degree of this handicap in France can be easily understood when I say that for the past year it has been almost impossible to procure any. This special preparation, whose composition is a secret, had another serious fault, that of being retailed at a very high price. Each lozenge cost fifty cents; it could, it is true, be used a certain number of times, but with each exposure it lost a certain amount of its value and precision. Finally, a further drawback, not generally known, to the

Holzkecht lozenges consists in the fact that after an exposure to the x-rays, when they are removed from their action their tint continues to turn and its change to increase, so that their color at the end of a sitting is not exact. In each operation the further change after the exposure has to be approximately estimated and taken into account.

In the circumstances in which we were placed, with two machines working continually, the time necessarily came when the perpetual use of Holzkecht's lozenges exhausted our supply, which could not be replenished. Still, in the meantime, we had acquired a requisite amount of experience with our machines and knew that one supplied five units H in twenty-five minutes, and the other in forty; so we continued our treatment on the basis of these simple time data. The machines had worked for five months without causing a single accident, and had given us an unbroken series of over a hundred recoveries, so that we had settled down to the idea that we were perfectly sure of our method, when a succession of accidents threw the whole question in doubt again.

Some repairs were made to our engines and the pulleys of the dynamos were altered; the result was an increase of a third in the speed of rotation of the static machines, and in the midst of the experiments to which we were driven by these alterations, our tubes gave rise to a series of cases of radiodermatitis and erythema, not very serious, it is true, but resulting in alopecic cicatrices in some instances.

These accidents showed us how much we needed some simple means of measuring the amount of x-rays necessary and sufficient to produce at one sitting the total and provisory depilation of a given surface of the scalp in this treatment. This was the origin of further researches, which ended in the invention of our radiometer X.

This instrument is based on the fact that the paper of spectroscopic screens (that is to say, a paper covered with an emulsion of barium platinocyanid in a collodion of amylacetate) turns under the action of x-rays and changes color in proportion to the amount of them it receives. In view of this fact it was easy to reproduce in water-colors the tint corresponding to that of platinocyanid paper when a radiotherapeutic sitting has been of sufficient duration to produce total depilation of a given surface of the scalp,

without radiodermatitis, erythema, or final alopecia. It is this color that is indicated by the tint B of our radiometer X; it corresponds to five H units of Holzkmnecht.

This reagent has three drawbacks which must be well-known:

(1) To begin with, its change in tint quickly disappears when exposed to daylight. If, therefore, your apparatus is working in full light, the reacting lozenge of barium platinocyanid paper must be placed in a sheath of black paper. Furthermore, when its tint is to be judged and compared with the guiding tint on the radiometer, it must be done with the least loss of time possible, since in a few minutes the paper grows pale and its tint is effaced.

(2) In the second place, the barium platinocyanid paper is less sensitive to x-rays than the Holzkmnecht lozenges. Whereas the latter have to be placed at a distance from the anticathode equal to that at which the skin is to be, this is not the case with the barium platinocyanid paper, which should be exposed at 8 centimeters from the anticathode, whereas the patient's scalp should be at 15 centimeters. This point is most important and should not be forgotten.

(3) Finally, the lozenge of sensitized paper should, during the entire exposure, be placed on a metallic surface impermeable to x-rays, such as iron, and not an absorbing one, such as aluminum, otherwise the change of tint of the lozenge will be less marked than it ought to be in proportion to the amount of rays that have fallen on it.

Under these conditions the barium platinocyanid paper is of easy use and puts both patient and operator in a state of absolute security that no other previous means had been able to supply. So long as this paper, exposed at 8 centimeters from the anticathode, has not reached the test tint of the radiometer X, there is no possible danger. Even when the length of the exposure to the x-rays has been unusual, it only proves that the source of the rays is a weak one. But as soon as this tint has been exceeded, accidents of radiodermatitis will be produced and will vary, according to the excess and the region under treatment, from mere erythema to an eschar.

It will now be seen by how much the radiotherapeutic formula of tinea treatment has been simplified. In order to cure a patch of tinea by x-rays it should be placed at 15 centimeters from the center of the tube, while at the same time a lozenge of barium platino-

cyanid paper should be placed at 8 centimeters from the center of the tube. When this lozenge has reached the tint B of one radiometer the operation is completed.

A scalp of which a portion has been treated in this manner shows no perceptible result at the time; but toward the seventh day an erythema, scarcely visible, manifests itself on the isolated region. This disappears four days later, when it is replaced by a pigmentation so slight that it has to be looked for to be seen. After 15 days the hairs fall out, without being pulled, over the entire area treated; in a few days depilation is complete.

It must not be imagined that the x-rays act as a parasiticide; they do not destroy the trichophyton—at any rate, under the conditions of experimentation mentioned above. The last fragments of diseased hair taken from the surface of the skin at the moment of their expulsion are still infiltrated with the living parasite; cultures made with these fragments are invariably positive.

The reappearance of the hair is a slow one, and this is an apparent drawback to the method, whereas really it is one of the reasons of its success; the last fragments of the diseased hair have long fallen by the time the new ones begin to grow. The new crop is already visible two months after the operation, and the growth is complete three months later.

The following is the manner in which the radiotherapeutic treatment of tinea at Saint Louis Hospital has been working for the past year.

In a closed room set aside for the purpose are placed, side by side, our two static machines, one with ten, the other with twelve plates, 55 centimeters in diameter, turning 950 times a minute; each machine is enclosed in a glass case. The conductors from each machine pass through the wall of the room and are carried to the spintherometer and tube in the adjoining or operating-room. In this way the operators avoid the noise of the working of the machines as well as the continual discharge of ozone which they generate. Again, by keeping the machines in a closed and well-ventilated room we avoid sudden hygrometric changes, the dust raised in a room occupied by people, etc. These two machines work six days a week, eight hours a day.

The machine with twelve plates, worked by the electric generators of the hospital, and running 950 turns per minute, furnishes

the quantity of x-rays corresponding to the tint B of our radiometer X in eight or ten minutes, according to the weather, hygrometric conditions, etc. The ten-plate machine requires twelve to twenty minutes to do the same work. Each day, counting the interruptions necessary for examining the children's scalps, the changes required each time in the adapting of the apparatus, its cleaning, etc., the big machine supplies twenty-five treatments and the little one fifteen.

The child to be treated is first examined, the tinea tested, and the number of patches ascertained. When the number of patches does not exceed five, as many rings are drawn on the scalp as there are patches, each ring having its center in the middle of a patch and its periphery passing 1 centimeter outside of the edge of the patch. These rings are made with tincture of iodine, and then with scissors by cutting a small circular furrow in the hair. As a general thing, all the patches on one head are treated one after another without a break; so many patches, so many applications.

When there are more than five patches of tinea our custom is to perform total depilation. To do this, we begin by drawing six large circles, two on the temples, one on the vertex, two on the parietals, and one on the occiput, taking care that their edges hardly intersect. When this has been done, each circle treated is covered with a leaden disc kept in place by means of an elastic band. The first six patches protected in this way, there remain the six intercalary spaces to be treated in succession. Total depilation, therefore, requires twelve applications, but even when they are done one after another the child under treatment is not even troubled by headache.

Commencing with the operation day and until the hair falls, an application of the following preparation is made every night over the entire scalp:

R	Oil of cade,	10 grams ;
	Lanolin,	25 grams,

which is washed off the following morning with soap, after which, again, the entire scalp should be painted with

R	Alcohol, 60 per cent.,	90 grams ;
	Fresh tincture of iodine,	10 grams.

The latter friction insures local prophylaxis and prevents the diseased hairs in falling from giving rise to fresh patches on the parts of the scalp that have been respected and not exposed to the x-rays. For it must be always borne in mind that in the diseased hair that falls the parasite is still living.

Finally, we often find that a ring of impetigo pustules occurs at the edge of the regions treated about the time that the hair comes out; this can be cured by applying the following preparation for a few days:

R	Precipitated sulphur,	10 grams;
	Alcohol, 90 per cent.,	10 grams;
	Distilled water,	80 grams.

After thirty days the entire head should be completely gone over to see that no point, however small, has remained diseased. At that moment, if the child's family demands his return, this can be permitted; but when the patient is not asked for, the moment of growth should be awaited, and by the time that the patches are almost half covered, the child can be sent home with a certificate for his school saying that he is no longer contagious. Still, he should return about once in two weeks to show his scalp, until his hair has recovered its ordinary length.

All that we now have to do is to show the results that have been obtained with this new process. The results are manifold and of different orders: (1) An increase in the number of tinea cases cured without entering the hospital. (2) A correlative decrease in the number of tinea cases treated in our wards. (3) A decrease in the length of time the patients remain in the wards. (4) Suppression of a portion of the hospital space given up to tinea cases and its availability for other purposes. (5) Suppression of the provincial colonies of Parisian children affected with tinea.

Formerly we cured tinea in two years; now we do it in three months. Parents who previously were unwilling to undertake for two years the care of their children's treatment, and asked for their admittance to the hospital, do not object to doing so for three months. They bring the child at regular hours for the radiotherapeutic application, and for the few visits of verification that precede in each case of tinea the delivery of a certificate of recovery.

Now a patient with tinea admitted to hospital in Paris costs fifty-six cents a day to the city; but treated in this new way it costs

nothing more than the radiotherapeutic applications, from one to twelve in number, which are worth about ten cents each.

Supposing the number of tinea patients not to vary, if the number treated at home increases, that treated in the ward diminishes; and this is what really happened. Already in January, 1904, I was able to return to the general hospital rooms of a capacity of 150 beds, and these beds now compose two entire new services, one of medical and the other of surgical cases.

Now a hospital bed represents a minimum capital of \$2000. One hundred and fifty beds, therefore, represent \$300,000, which the x-ray treatment of tinea has turned over to the general hospitals in the first year of its application. And there is no doubt that the time will soon come when the space at present devoted to tinea patients will prove to be too extensive again.

Up to 1903 the tinea patients at Saint Louis Hospital remained there about two years each. Nowadays, the treatment requiring only three months, the duration of the disorder is shortened by about five-sixths. Basing a day, then, as we have said, on a price of fifty-six cents, a recovery formerly cost about \$400 for a child in the hospital, whereas it now averages \$52.

Finally, at the time when a child required two years' treatment, a number of tinea children were sent down to school-colonies in the country, as many as 350 being disposed of in this way at a time. Of these three colonies, the first has not received a fresh case this year; the second is being gradually extinguished, and the same process can be applied to the third whenever desired.

Such, then, is the balance-sheet of the x-ray treatment of tinea for the year 1904.

# Medicine

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## THE DIAGNOSIS OF INCIPIENT THORACIC TUBERCULOSIS<sup>1</sup>

BASED ON A STUDY OF FIFTEEN INCIPIENT AND SEVENTY-ONE ADVANCED CASES

BY ROBERT N. WILLSON, M.D.

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the Philadelphia General Hospital

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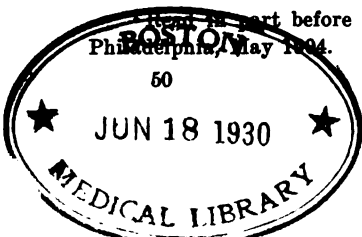
THE following study of a series of cases of incipient tuberculosis seen in private practice, and of 71 more or less advanced cases studied in the wards of the Philadelphia General Hospital is presented in the hope that it may lend a new interest to a hackneyed subject—the importance of a careful examination of patients with apparently trifling conditions.

My experience, especially during the last year, has forced me to the belief that not only many cases of incipient phthisis are overlooked, but that it is a particularly difficult matter to obtain a confirmation of the diagnosis when it is made in a truly incipient case.

Of the 15 patients already mentioned nearly all were seen at some time in consultation with other members of the profession, and in only two instances did the consultant find himself able to agree with the positive or even probable diagnosis. Usually, the stumbling-block was the absence of tubercle bacilli from the sputum; sometimes it was the lack of fever; often the physical signs did not appear extensive enough; occasionally some one cherished symptom was absent, and until that was obtained the diagnosis was considered impossible. In one case the patient, without my knowledge, visited three different consultants in this city after

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<sup>1</sup>Read in part before the Medical Section of the College of Physicians of Philadelphia, May 1904.





hearing my diagnosis of incipient tuberculosis of the lung. Of these one told her that she had only a bad cold; the second, that she probably had not tuberculosis; and the third (the head of one of our tuberculosis sanatoria), examined the chest without removing any of the clothing, and informed her that she had a healed tubercular lesion. A few weeks previously I had found tubercle bacilli in her sputum.

In many of the following incipient cases, it may be stated, tubercle bacilli were found at some time, sooner or later, in the sputum. In a number, the diagnosis was concurred in by Dr. E. L. Trudeau when the patients were finally sent to him for treatment; among these was the case last cited. All served to illustrate the reluctance of the medical man of to-day to diagnose tuberculosis in the absence of the so-called classical signs.

CASE I, Miss B., of a series of 15 instances of incipient phthisis seen in private work, was that of a young woman, born in England 28 years ago. She consulted me in November, 1903, with what she believed to be a bad cold. She insisted that her family history was perfect; but on being questioned admitted that her father died of pneumonia and her mother of pneumonia in Bright's disease; five brothers and a sister died in infancy; one sister died of phthisis florida, and another sister is at the present time an invalid, though, as far as known, has not phthisis. One maternal uncle died of phthisis.

The patient's personal history was negative until a year before she consulted me. She then (winter of 1902-3) contracted a bad cough which lasted until midsummer. With this constant cough appeared a profuse mucopurulent sputum, in which at no time could blood be detected. During the ensuing summer, even, the cough and expectoration never disappeared, although throughout the past autumn the cough was very slight up to within two weeks of the time of her consulting me. Since then it had been constant, the expectoration free and of a greenish-yellow color, no blood being noted at any time. She never had any pains in the chest. Palpitation was extreme on exertion,—a symptom that she had noted since childhood. She had vomited almost all her meals for three weeks, and said they were unappetizing. She had never had night-sweats; had never lost weight.

The patient appeared, to the casual observer, healthy and ro-

bust. On examination the chest was found to be of a markedly "funnel" type, expansion poor on both sides (rather less free on the right side), and occasional fine crackling râles were heard over both apices anteriorly and posteriorly; also prolonged rough expiration, suggestively tubular in character. The percussion resonance was much impaired over the right apex anteriorly and posteriorly, especially as compared with the left side. There was no flatness. The contrast became even more decided upon a retained full inspiration. Under the right clavicle was a distinct depression; there was also a slight and probably abnormal increase in the tactile fremitus; whispered pectoriloquy could be faintly made out. The heart showed a marked arrhythmia, and a faint murmur was heard with the systole only over the base. The glands of the body showed no enlargement.

The remaining physical examination proved negative, except that the temperature was subnormal, and that the urine contained a faint trace of albumin, but no renal sediment. The blood was normal except for a slight reduction of the hemoglobin.

The sputum was examined, and appeared distinctly nummular, pale greenish, and contained a few streptococci, many colonies of diplostreptococci, many diplococci, and no tubercle bacilli. No elastic tissue could be detected.

This condition of affairs appeared to persist, the only change occurring in the breath sounds over the right apex which now became markedly tubular, inspiration and expiration being of equal length and rasping in character. There was, however, an entire disappearance of râles from the apex of the left lung. On December 4, 1903, the patient stated that she had had on that day a slight bleeding from a tooth. The temperature was on all occasions subnormal. The sputum was repeatedly examined, and on December 7, 1903, together with many diplococci and streptodiplococci, a few tiny, short bacilli were found, staining typically and resisting both acids and alcohol. In consultation with Dr. John H. Musser the diagnosis of probable tuberculosis of the right upper lobe, and especially of the apex, was concurred in, and the patient was placed in bed in my own home for closer study. Up to this time she had had none of the classical symptoms of phthisis pulmonum. On December 9, 1903, to use her own expression, she "spit up blood for the first time." The sputum, examined on this day, was full of diplo-

streptococci and diplococci. No tubercle bacilli could be discovered. A slight red tinging of the sputum was evident macroscopically. No elastic tissue could be found.

Between December 9 and 12, 1903, the sputum was examined seventeen times. It was always mucopurulent, sometimes showed a streak of red, but no tubercle bacilli were found. On December 13 four specimens were examined and two typical tubercle bacilli

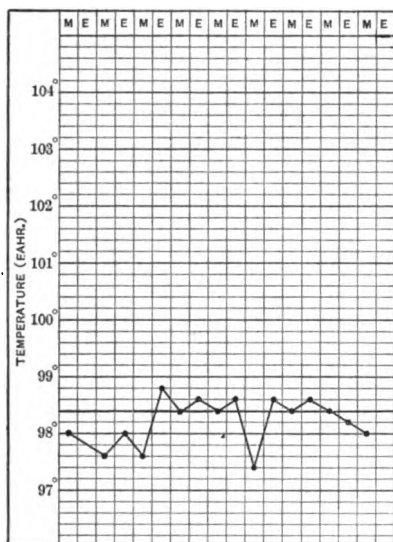


FIG. 1.—Temperature record (for several days) in Case I.

were discovered, as well as many scattered, short, very tiny, atypical bacilli, staining typically, however, and resisting both acids and alcohol. A small quantity of elastic tissue was noted.

While in bed the chest became much clearer, the left lung showing no abnormality, though the same apical symptoms persisted over the right side, especially also along the right edge of the sternum in the first and second interspaces, and posteriorly along the spine of the scapula. On December 18 Dr. Musser concurred in a positive diagnosis of incipient tuberculosis of the right apex. The patient was advised of the condition and of the probability of complete recovery under an appropriate *régime* and dietary.

On the 29th of the same month she came to my office to say that she had consulted another member of the profession, who had pronounced her ailment "a bad cold only," and made the positive statement that there was no tubercular process present. This con-

sultant, it is interesting to state, examined the chest at first through the dress, then over the bare skin at the demand of the patient. He saw her on one occasion only, and examined neither the sputum, the urine, nor the blood.

The patient then, and again without my knowledge, consulted one of our most eminent diagnosticians, who examined her chest once, and pronounced her "probably not tubercular." His report of "no tubercle bacilli" was obtained from the examination of a single specimen that was mislaid for three days prior to its examination.

She then in despair, and still on her own responsibility, consulted the head of one of our foremost institutions, devoted solely to the study of tuberculosis. The examination was made through a dress, a corset-cover, and a low corset-waist, not even the collar being removed. A thermometer was placed in the mouth, retained in position for ten minutes, and the patient was told that her temperature was typical of tuberculosis. The diagnosis of a "healed (or convalescent—she could not be sure which) tuberculosis of the right apex" was formulated. No examination of the sputum was suggested, and none was made.

The patient then visited me with a recital of her numerous consultations, and requested advice. In spite of the positive physical signs which are still present in her chest, it is interesting to be able to say that the patient has steadily gained in weight under a careful hygiene and overful diet, and now seems to be progressing toward a probable cure in a more favorable climate.

I think there will be no one who reads the preceding history of this case, but will admit that, from the patient's stand-point, at least, a satisfactory and conclusive diagnosis of incipient tuberculosis is still hard to obtain, especially if too many authorities are consulted.

Let me cite very briefly the physical signs of 14 other cases seen in a little over one year of private work (1903-4).\*

CASE II.—H. G., a retail liquor dealer, aged 36, born in Ireland. His father died of gastric trouble; his mother is alive and well. One brother died of phthisis one year ago. The patient has three children and a wife, all of whom are well. He has always been well and strong since childhood, until a year and a half ago. Since that time he has had a tickling cough and some slight expectoration, which has never contained any blood. He has never

had night-sweats. He has frequently had diarrhea and attacks which he terms cholera morbus, characterized by watery stools and acute abdominal pain, usually following a debauch. Fifteen months ago he had a large hemorrhage which he believes to have come from his nose. No bleeding before or since that time. About three weeks before consulting me he was treated by his then physician for "an attack of pleurisy."

On August 15, 1902, I saw him at his house an hour after he had had a large hemorrhage of bright red blood from the mouth. By his side was a large basin full of blood. In response to questions he stated that he had never in his life been short of breath. He had always been a constant and hard whiskey drinker; he denied all history of venereal infection; had lost about 40 pounds in weight during the past year; had never had pain until just prior to this hemorrhage, when he experienced an intense pain in the epigastrium. When seen by me he was blanched and pale from loss of blood, and very weak; his temperature was subnormal; he had then no pain, no cough, no expectoration. He brought up constantly, though lying on a couch, mouthfuls of blood, without coughing.

His chest was well formed, large, and symmetrical. Over the right apex posteriorly the percussion note was slightly less resonant and higher in pitch than on the left side. The breath sounds were rough over this area, but there was no distinctly tubular breathing. Over the left apex posteriorly there was heard a sharp click with each inspiration, the resonance was unimpaired, and no râles were heard elsewhere.

Within a short time the temperature had risen to 101° F., with the pulse 100, and the respirations 20. The cardiac second sound was everywhere accentuated, the examination of the heart being otherwise negative. Over the pylorus, in a small area, there was exquisite tenderness on palpation, also some rigidity and some constant pain. The physical examination showed nothing further of note. The blood examination revealed the hemoglobin to be 55 per cent.; the urine contained a few hyaline casts, but no albumin.

From this time until the third day the patient constantly expectorated bright red blood; it then suddenly ceased, possibly as the result of the treatment with gelatin and calcium chlorid. He then developed delirium tremens. Several large hemorrhages of

bright red blood occurred during the following week. The temperature gradually fell to normal, and then remained subnormal. After five weeks in bed he gradually gained strength enough to take the trip to Colorado.

During the entire time the only physical signs of tuberculosis discoverable were those already cited, and on one or two occasions a few fine, crepitant râles, or, as I like to call them, crackles (because the term describes them more graphically), over the left apex posteriorly. The sputum was persistently examined, and once or twice a few typical tubercle bacilli were found. On all occasions streptococci and diplococci were found in abundance.

On August 27, 1903, the patient returned subjectively perfectly well, but caught cold on the train. His chest when examined by me presented anteriorly rough breath sounds over both apices, but no dulness on percussion, and no râles could be distinguished. Posteriorly over the apex on the left side were heard a few fine crackles and a slight pleural creaking. He returned to Colorado at once and has remained well there up to the present time.

CASE III.—J. E. W., a young Australian, aged 20 years, was referred to me while he was a student at the Drexel Institute, because of a profuse acne of the face. No tubercular history could be obtained on either side of his family. The patient had always been well and strong until four months before, when he developed a constant hacking cough, and much morning expectoration. All of these facts were elicited with difficulty after the physical examination. Last winter he had had night-sweats whenever he caught cold. For four months he had considerable discomfort in his right upper chest, prior to seeing me on August 10, 1903. His sputum "was often brown, but had never contained any red blood." He had lost five pounds in the four months.

His chest was well developed, with unusually good expansion equal on both sides, but over the apex of the right lung posteriorly and along the spine of the scapula were heard a few dry crackling and a few wheezing râles. The breath sounds were rough, but there was no tubular breathing. Expiratory sounds seemed prolonged. The percussion note and both tactile and vocal fremitus appeared normal on both sides anteriorly and posteriorly. Over the left apex posteriorly the breath sounds were rough, but no râles were heard even after coughing. Further physical examination was negative.

The sputum was thick, greenish-yellow (not nummular), and contained no blood. It was full of staphylococci, streptococci, and diplococci, and various large fungi. No tubercle bacilli were detected.

The patient laughed when I told him that I found a slight involvement of the lung, and inflated his chest to show the impossibility of such a state of affairs. One week later he returned to say that the cough had nearly disappeared and expectoration had entirely ceased. The râles could not be detected upon the most careful examination over the right apex, though the expiration was slightly tubular and the breath sounds were rough over both apices, especially the right posteriorly. The temperature was 97.5° F.

On November 9, 1903, he came to my office immediately after having a large hemorrhage from the mouth (estimated by him as a pint). The temperature again was subnormal. On examination both the right and left chests showed good expansion. Below the right clavicle the breath sounds were rough, but there were no râles even after a forced cough. Over the left subclavicular region the sounds were fairly normal. Over the right apex posteriorly and over the entire left upper lobe posteriorly was heard a loud tubular expiratory sound, probably originating, as was afterward determined, in the right upper lobe. The percussion note was slightly impaired over both apices posteriorly, especially noticeable on forced inspiration. No râles could be detected.

The sputum obtained on this day consisted of thick greenish muco-pus, and contained a trace of red blood and many small caseous bodies. These were a few diplococci and staphylococci and many morphologically typical tubercle bacilli present.

Two days later (November 11) he had another hemorrhage (estimated about a half-teacupful) after a coughing spell. The patient looked pale and wan. Temperature, 99.8° F. At this time there was loud tubular breathing anteriorly and posteriorly over the entire right upper lobe. Distinct friction sounds were heard; and, after a cough, many fine crackling râles over the right upper lobe posteriorly.

One week later the patient started for Australia. He now writes that he is improving rapidly, that his cough has nearly disappeared, and that he feels almost well again.

CASE IV.—M. H. B. was especially interesting to me because my positive diagnosis of tuberculosis was combated vigorously prior to the discovery of tubercle bacilli, and indeed because of their absence from the sputum.

A young man, aged 23 years, preparing to be a missionary, was sent to me on December 5, 1903, with "a bad cold." His mother had died of phthisis, as had also several members of his mother's family. His father has "catarrh;" one sister has pulmonary trouble, the character of which my patient did not know.

He himself was always well until two years ago, when some one pulled a chair from under him, causing a fall and an injury to the spine. He was an invalid at this time for three months. Long prior to this fall, and often since, he has coughed and spit up blood. His nose bled easily and often. He had coughed for "several" years (exact number unknown), and when seen by me expectorated freely, but thought the blood came from his nose. He had lost 10 pounds in the last year, but had never had a night-sweat. He has had some gastric and abdominal pain. His temperature 99.5° F., his pulse 96, and his respirations normal. On examination he appeared sallow, his chest large and well developed, the expansion good on both sides. Below his right clavicle there was a marked depression. The tactile fremitus was decidedly increased over this area, and loud tubular breathing was heard here and elsewhere over the right upper lobe. A few crackling râles were heard after the cough. The left lung appeared practically normal, except for a suspicious roughness of the breath sounds.

On December 7, 1903, the sputum showed a few tiny atypical bacilli, retaining the carbol-fuchsin stain in spite of acids and alcohol. (The specimen was shown at the Pathological Society, also to Dr. Stengel, who saw the patient in consultation, and pronounced them "probably not tubercle bacilli.") Red blood appeared in nearly every specimen examined, and in nearly every specimen the same tiny, very short, atypical bacilli were found. Twenty specimens were studied at the University laboratory by Dr. Evans, and no tubercle bacilli were found. A number of specimens were also studied by Drs. Stengel and Pepper, by whom finally a few typical bacilli were found. Typical bacilli were found in my own twenty-first and twenty-second examinations.

After December 9 (temperature then 99° F.) the patient



showed a subnormal temperature between 97° and 98.6° F. In December, 1903, I sent him to Dr. E. L. Trudeau, at Saranac Lake, who is treating him as a probably curable case of tuberculosis. The patient wrote on January 7, 1904, "my temperature has been normal and I have had very little coughing. The blood-streaked sputum still continues. I have gained about five pounds since I arrived here, and feel much better."<sup>2</sup>

CASE V.—Mrs. F., aged 27 years, was brought to me by her husband a few weeks ago after noting a slight trace of red in the sputum. On both the father's and the mother's side there had occurred frequent cases of tuberculosis in the ancestry. One sister of the patient died of phthisis. The patient herself had always been well except for the ordinary diseases of childhood. A few weeks before her marriage she had weighed 98 pounds. When brought to me four months later she weighed 105. She had recently caught cold, with sore throat, expectoration, etc. A few days previously she had gone down town on a cold day in low shoes, and had coughed ever since. When seen by me the patient described as a recent symptom a sharp stabbing pain in the epigastrium. She had felt dragged out and tired all fall, especially during the last days, and had a number of night-sweats. She had noticed blood, usually in faint streaks, in the sputum, in all, five or six times. Her cough was constant and racking. She said she could not take a deep breath. One week earlier she had had a severe laryngitis, and lost her voice for the time being. She had one cold after another for six weeks, and had considerable pain over the epigastrium, which had been constant, and had no reference to meals. She had considerable palpitation and some dyspnea on exertion.

She was examined by me on November 24, 1903, though in an imperfect manner owing to her objection to a complete undressing, because she thought the examination altogether unnecessary. No abnormality was discovered in the chest at this time other than a slight roughening of all the breath sounds, and a lengthening of the expiratory sound over both apices. The further physical examination was negative.

The sputum, obtained from the handkerchief, and containing a trace of bright red blood, showed diplococci in abundance and many

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<sup>2</sup> This patient has recently returned to Philadelphia apparently cured.

colonies of a tiny diplobacillus (probably influenza), but no tubercle bacilli.

The urine was negative. The patient then improved slightly, until ten days or two weeks before being examined by me on January 3, 1904, this time, however, with the chest fully exposed. Her evening temperature was taken at my request at frequent intervals, and was found constantly subnormal. The patient was very pale. There was no enlargement of the glands; the arteries were pliable and soft. The chest expanded equally on both sides. On forced expiration and inspiration there was impairment of the note on percussion under the right clavicle and in the right supraclavicular fossa. The fremitus (tactile and vocal) was increased over the right apex anteriorly and posteriorly. The breath sounds were harsh but not tubular. There was slight pain over the right apex on gentle percussion. Posteriorly along the midportion of the spine of the right scapula were heard a few fine crepitant râles, and a slight pleuritic rubbing. Coughing increased all these signs. The left side presented no abnormality other than a harsh type of otherwise normal breath sounds. The temperature was 98° F., as at the first examination.

The sputum examined the previous day contained a very few tiny, faintly staining, but otherwise morphologically typical tubercle bacilli.

The blood examination showed, hemoglobin 78 per cent., erythrocytes 4,692,000, leukocytes 16,000; no abnormal morphologic changes.

The patient was later seen in consultation with Dr. Stengel, and the diagnosis also concurred in by Dr. E. L. Trudeau.<sup>3</sup>

CASE VI.—L. R., a man of 26 years, a tailor, was born in Italy, but had resided in Philadelphia since childhood (sixth year). His father was syphilitic (prior to the birth of my patient) and had infected the mother. Two brothers of the patient are strong and active, but one has a bald and scabby head (possibly syphilitic). One married sister has phthisis. No other case of pulmonary disease has occurred in either the father's or mother's family.

As a child the patient had almost no illness. Typhoid fever eight years ago. Has never shown any symptoms of inherited

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<sup>3</sup> This case has also resulted in apparent cure.

syphilis. Eight years ago he weighed 162 pounds, now 135 pounds. Has not lost weight in the last year or two. Has coughed since his earliest recollection. For the last three years has coughed up yellow muco-pus, and the cough has during this time become more frequent. Sometimes the sputum has been slightly streaked with blood. Two days before he was examined by me this occurred for the last time. During the last year he has experienced some pain in the midsternal region, anteriorly and posteriorly. Pain on coughing has been felt only on the right side over the shoulder; the latter has been a constant symptom. He now has very little sputum, his cough is very dry, but he is always feverish and hot, and cannot tolerate the covers at night. Has taken his own temperature regularly and found it in the mornings  $97^{\circ}$  to  $98^{\circ}$  F., and in the late afternoon  $100^{\circ}$  to  $101^{\circ}$  F., or even  $103^{\circ}$  F.

He had consulted two physicians, both of whom intimated that he had phthisis. Neither one had been able to find tubercle bacilli in the sputum. The dyspnea is now marked on exertion, the appetite is poor, the bowels constipated. The patient has also had repeated attacks of appendicitis, and the appendiceal region, even between attacks, is constantly sore to the touch. His last appendiceal attack occurred one year before. He has had much sore throat, and says that this condition is common in his family (*vide* previous history of father's syphilis). He was told by his last physician, that he had renal disease; and by his wife since that time that his eyes and also his face are often puffy.

On examination on December 18, 1903, he was found to be generally well developed. No eruption on either skin or mucous membranes. The glands were not enlarged. The chest showed a marked depression above and below the right clavicle, the patient voluntarily stating that this depression has lately become more marked. Over the right apex, especially just below the clavicle and over the first and second interspaces, loud tubular expiration was heard, the inspiration being decidedly rough. Vocal resonance and fremitus were decidedly increased over this apex, anteriorly and posteriorly. Positive impairment of percussion resonance below the clavicle, and over the apex on the right side anteriorly. Posteriorly loud tubular expiration was heard over the right upper lobe down to the spine of the scapula. No râles could be distinguished. Posteriorly over the left apex there were a few semi-

crepitant râles, but no other abnormality. The cardiac action was rapid, but otherwise good. The abdomen showed marked pain and rigidity localized over McBurney's point.

The urine was normal except for a high specific gravity (1022 to 1031). On December 21, 1903, his temperature was 99° F., the pulse 88, the respirations normal. The physical examination gave the same results, except for a few soft râles on expiration over the right apex anteriorly. The patient had gained 10 pounds. The sputum was examined repeatedly, but no tubercle bacilli could be found. The blood examination showed, hemoglobin 96 per cent., erythrocytes 5,240,000, leukocytes 3800; no morphologic abnormality. The urine was again examined on January 5, 1904, and again found negative.

On January 11, 1904, fine râles could be heard easily over the entire scapular area on the right side, also below the clavicle, and many fine soft râles also posteriorly over the left scapular area. Anteriorly the left lung appeared normal.

Bacilli could at no time be found in the sputum, although many attempts were made. The patient is now in Colorado, and is improving rapidly in the open air.<sup>4</sup>

CASE VII.—Miss G., a young single woman, aged 21 years, a school-teacher. Her father died of Bright's disease; her mother is living and healthy; one brother died of cardiac disease following rheumatism; one brother died last year of phthisis, aged 17 years (the condition having been diagnosed rheumatism of the chest muscles). Another brother has a double mitral lesion originating in an attack of rheumatism.

The patient has always been well except for nasopharyngeal catarrh; she has had repeated operations "upon the throat." About three years ago she began to feel weak, and had vague pains in the chest which the doctor had also told her were rheumatic. At that time she weighed 139 pounds. On October 10, 1903, when examined by me, she weighed 126 pounds. She has had a slight hacking cough constantly for two or three years, except in the summer, and considerable expectoration, never containing blood. She has never had night-sweats. Her appetite recently

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<sup>4</sup>It should be stated that pulmonary syphilis has never been absolutely excluded in the diagnosis of this case.

has become poor. Bowels are regular. Menses have always been regular.

On examination, I found her a pale, anemic girl, with a nasal obstruction, a poorly developed chest, the right side of the thorax



FIG. 2.—Temperature chart in Case VII, covering a brief period prior to treatment.

congenitally imperfect, the right arm and shoulder atrophied, an entire absence of fingers on the right hand. A marked depression above and below the right clavicle. Pulmonary expansion was fairly good on both sides, less so on the right. No difference was discernible in tactile fremitus. Vocal fremitus and whispered pectoriloquy were distinct over the apex on the right side. Marked impairment of percussion resonance with higher pitch of note over the right apex and below the right clavicle. Distinct tubular breathing and prolonged expiratory sound over this area. No râles distinguishable. On the left side the only abnormality discovered consisted in a few fine râles over the extreme apex anteriorly after a forced cough.

The urine showed a trace of albumin in both the morning and evening specimens, but no renal sediment. The sputum was seromucous, contained no blood, and showed microscopically a few streptococci, but no tubercle bacilli.

The same conditions persisted in the chest until November 21, 1903, when a marked improvement began to be apparent. The depression above and below the clavicle on the right side became

less and less marked, the patient gained constantly in weight, and the cough and sputum entirely disappeared. The temperature had occasionally reached 99.4° F. when she had been tired physically, but on most occasions it had ranged from 98.2° F. to normal. Since January 25, 1904, the temperature has been constantly normal or subnormal, and the patient feels perfectly well. There were present on February 27, 1904, loud tubular expiration (heard especially well in the subclavicular region in the first, second, and third interspaces near the sternum; also over the apex posteriorly), and a few fine crepitant râles along the scapular spine and the root of the right lung, near the vertebral column. The left lung appeared normal. Tubercle bacilli have never been discovered in the sputum in spite of repeated and persistent examination.<sup>5</sup>

CASE VIII.—Miss E. W., a young woman of leisure, aged 27 years. One sister has apical tuberculosis and experienced eclampsia in her last confinement. The family record shows no other case of tuberculosis on either side as far back as the great-grandparents. The patient was first seen by me on August 22, 1902, for a condition which simulated gastric ulcer. She also at that time presented a diffuse ulceration of her postpharyngeal nasal chambers and of the tonsils. The ulcers had a clean base, and were small in size. Both the gastric and pharyngeal symptoms disappeared after a long treatment of her excessive anemia. Ever since an attack of typhoid fever, 10 years before, she had had an unreliable digestion, and had always been indiscreet in her dietary. On December 24, 1902, after a brief illness, with symptoms referred entirely to the appendiceal area, the appendix was removed by Dr. Le Conte, who saw her with me at that time. Following this operation were several months of intense physical depression, operative neurasthenia in a pronounced form. She was finally sent away for a long rest with strangers, and gradually recovered. Prior to the operation and gradually increasing since the latter, she has complained of a vague pain, aching, constant, and dull in character, and at most times referred by the patient to the hip. The temperature was constantly a trifle above normal. The right hip showed slight bulging over the head of the femur, the right

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<sup>5</sup>Since this paper was prepared (nearly a year ago) the patient has returned to Philadelphia apparently cured.

pelvis was tilted upward, and there was an indefinite pain over the right pelvic bone on pressure over the head of the right femur or over the sacro-iliac joint. There was present also a slight lateral curvature of the spinal column which was noticed by the mother, who said it had not been there during the childhood of the patient. Tuberculosis of the hip was considered and later tuberculosis of

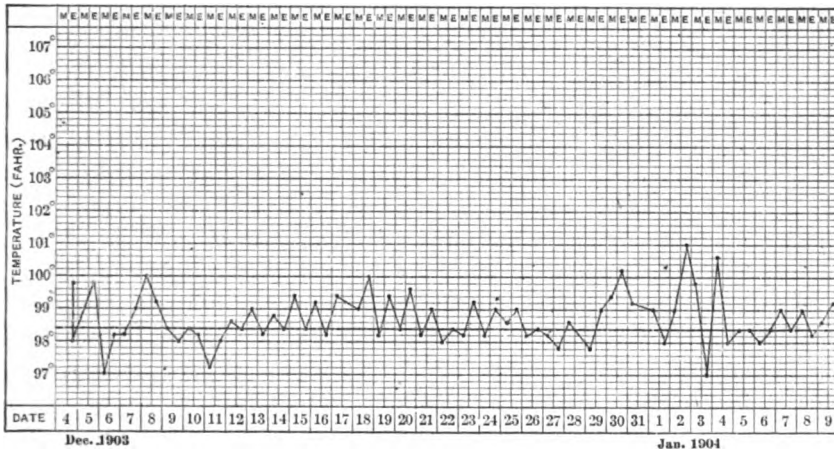


FIG. 3.—Temperature chart in Case VIII.

the sacro-iliac joint or of some other portion of the bony pelvis, but no accurate diagnosis could be made. The chest was repeatedly examined, and at no time were the physical signs in any way abnormal. There had been no cough and no sputum for months past. The weight of the patient on November 23, 1903, equalled the greatest of her recollection. She was then seen in consultation with Dr. LeConte and later with Dr. G. G. Davis, both of whom refused to accept the diagnosis of tuberculosis. She was then examined with me by Dr. Morris J. Lewis, who concurred in the diagnosis of probable tuberculosis of the bony system, localization uncertain, but probably in the hip-joint. Dr. Lewis also could find no abnormality in the chest. The temperature was taken morning and evening from this time (December 4, 1903) until her departure for Colorado, on January 9, 1904, and the intensely interesting chart (kept by herself) is appended (Fig. 3). The pulse-rate varied from 100 to 110.

On January 9, 1904, she was examined by me for a last time, and with the chest as usual entirely exposed to the skin. There

was no cough and no sputum. Over the right apex was heard for the first time a faint tubular inspiration and expiration. There was also a slight but distinct impairment in the resonance on inspiration and expiration over the right apex and the subclavicular region. The fremitus was relatively increased. Anteriorly there were no râles. At the lower angle of the scapula was heard a distinct constant click, as of air being pulled through a sticky exudate. The left lung appeared absolutely normal. At no time within a year had there been sufficient sputum for a bacteriologic examination. The patient has now been in Denver for a month, and writes that all her symptoms are exaggerated. She has constant cough, profuse mucopurulent expectoration, and the pain referred to her right hip is constant.\*

CASE IX.—J. C., Jr., a young man, aged 29 years. His father has cardiac disease, his mother is alive and well. His paternal grandmother died of phthisis florida. No other case of phthisis is known in the family history.

At 10 years of age the patient had cardiac rheumatism (pain, suffocation). He never had typhoid fever or scarlet fever, but all of the ordinary diseases of childhood, and denies venereal infection. Up to one year ago he was fairly well, though he had headache and was always tired. On May 6 last he "felt cold in his back." Felt like falling down, as if he was going to be sick. His physician told him his temperature was 106° F. He had begun to cough in the preceding March, the cough amounting to a simple hack or a clearing of the throat. At this time he had severe pain in the chest. Since then the sputum, which before was scanty and liquid, has become greenish, thick, and sometimes is voided in thick solid pieces. In July he brought up streaks of blood for the first time. He has coughed constantly, with occasional appearance of blood in the sputum. Night-sweats were severe for six weeks in August, and then disappeared. He weighed 178 pounds in 1897, now weighs 168 pounds. When weighed by me the scales registered 162 pounds. He says that he has frequent pain under the clavicles and anteriorly along the hepatopulmonary

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\*Vaginal examination, on her return home, discovered a small semifluctuating mass in the right vaginal vault, which abdominal section proved to be an ovarian cyst, the removal of which caused the hip and sacro-iliac symptoms to entirely disappear. The irregular temperature, expectoration, etc., still persist.



border. Much palpitation and precordial pain. Two weeks ago the pain seemed to penetrate the lung to the back. In May of last year his physician told him that his right lung was seriously affected. He then came to Philadelphia and consulted a homeopath, who told him as recently as the week in which he was referred to me that his lungs were perfect, but that his heart was affected, and denied that he had tuberculosis. During the last few days the patient has had chills down his back, sometimes severe so as to cause him to shake. The temperature is usually 97° to 98° F. in the morning, and 99° to 100° F. in the afternoon. It was 101° F. after my examining him in my office.

Depressions were evident in both infraclavicular fossæ; over the right apex a slightly tubular breathing and a long tubular expiration were the only abnormal physical signs. Over the left apex anteriorly below the clavicle there was a long harsh expiratory sound. Above the clavicle a shower of fine râles was heard after coughing. A decided impairment of percussion resonance and a higher pitched note were present over the left apex above and below the clavicle, as compared with the left side. Posteriorly there was the same difference. No râles. The fremitus did not seem exaggerated to the hand on either apex, but there was distinct whispered pectoriloquy over the left apex anteriorly and posteriorly. A number of preparations from two specimens of sputum were examined, and though each contained red blood, no tubercle bacilli were found. The urine contained a faint trace of albumin, but no renal sediment. The patient was last seen on January 27, 1904, just before his departure for Arizona. Fine crepitant râles were heard over both apices, and on the left side from the supraclavicular fossa back to the spine of the scapula. Percussion was distinctly impaired over the left apex anteriorly and posteriorly. The temperature since he was last seen had been constantly 99° to 101° F.

CASE X.—Miss B. is a young woman of leisure, aged 19 years, brought up with the greatest care by a mother who never allowed herself to forget that her own mother died of phthisis. There is no other case of phthisis in the family history on either side. The mother has diabetes mellitus. The patient has always been well and strong since childhood. She had the ordinary diseases of childhood and also a slight pneumonic involvement of the right base,

which Dr. A. V. Meigs, who attended her at that time, has informed me was an irregular bronchopneumonic process.

One year before she came under my care (March 16, 1903) she began to have a hacking, irritable cough, "especially when leaning forward against her desk." This began with a bad cold, with considerable yellow expectoration. The sputum has since that time been very scanty and never streaked with blood. She has no pain in the chest and has felt perfectly well except for occasional sick headaches. The patient was treated up to the time she was

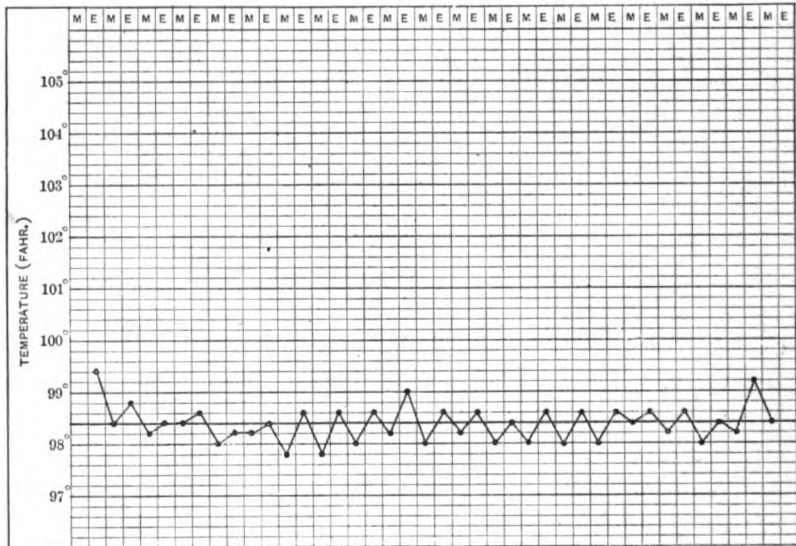


FIG. 4.—Temperature chart in Case X.

seen by me by a prominent laryngologist, who told her that she had a chronic laryngitis. Her cough at this time appeared to depend upon an irritable, possibly nervous, condition of the air-passages directly under her sternal notch.

On examination by me she was seen to be a well-built girl, of good color, though her hands were very cold at all times. The chest appeared to be absolutely normal, the breath sounds all clear, the cardiac condition perfect. The larynx, pharynx, and tonsils all appeared normal. The urine showed a faint trace of glucose, but no renal sediment.

Local treatment with the electric current was begun as much for its mental effect as for its local stimulation. Terebene was also used

in ascending doses. In two months, with no other treatment, the cough entirely disappeared and the patient seemed well. She remained so during a summer spent in the open air, and throughout last autumn (1903). On December 26, 1903, she returned with the statement that "for a week or ten days she had had her old cough." The same point in the larynx seemed again to be irritable. During the winter she had been overdoing society life, and was exhausted as a consequence. She had had no pain in the chest, little expectoration (usually none), and no blood in the latter at any time. She looked and felt well, except tired, and appeared to have lost weight. The electric current had no effect upon the cough, and for reasons that appeared clear at once upon the physical examination. The hands were bluish and very cold, and the patient stated that people often commented on this peculiarity. The chest was well developed and the expansion good, though there was a slight difference between the expansion of the two sides, a depression below the right clavicle not filling up completely during inspiration. The breath sounds over the right apex, anteriorly and posteriorly, were suggestively tubular, the expiratory sounds especially being long and harsh. No râles could be distinguished. The left lung appeared to be absolutely normal. The physical examination was otherwise negative. The hemoglobin was 68 per cent., the blood otherwise normal. The urine showed a faint trace of albumin, but no glucose, and no renal sediment.

The physical signs persisted as above, though the tubular character of the apical breath sounds seemed to intensify gradually until January 8, 1904, when she "caught a new cold." She came to me two days later to say that her cough had been getting better for a few days, but is again constant. She "perspires very freely" in bed after coughing in the early morning hours. The physical signs appeared the same except that the tubular breathing could now be heard in the right axilla, probably transmitted. Temperature, 98.8° F. Temperature on January 10, 1904, was 100.4° F. On January 14 her temperature had been nearly normal since the last note. She had coughed much less. On this visit she complained of pain in the right ear, and then suffered from Eustachian congestion for the next ten days. For the first time a few fine crepitant râles were heard anteriorly and posteriorly over the right apex, espe-

cially after a cough, and below the clavicle and also along the spine of the scapula. The patient looked also for the first time thin and sallow.

During the next three weeks the physical signs steadily increased in distinctness, and the family of the patient was finally persuaded to send her to Saranac. Since that time Dr. E. L. Trudeau has had her in charge, and writes that there is a steady improvement in the general and local condition.

During the period from December to February sputum was obtainable only twice, and on neither occasion could tubercle bacilli or elastic tissue be detected. At no time was there a trace of blood either in the scanty expectoration or on the handkerchief. The temperature during the two weeks prior to her leaving for the Adirondacks was subnormal in the morning with regularity, and sometimes also in the late afternoon. Sometimes there was an afternoon rise to 99° or 99.5° F. It would appear as though this patient developed tuberculosis while under observation.<sup>7</sup>

CASE XI.—F. G. D. is a student in the University aged 21 years. His father died of renal disease. His mother has had an apoplectic attack. His maternal aunt and uncle both died either of "quick pneumonia" or phthisis. His maternal great-aunt also died of phthisis.

The patient has always been well, except for a severe attack of malarial fever when six years old. For the last two years he has caught cold very easily and persistently. One year ago he had much pain under both clavicles and over the apices. Sputum was abundant but never contained blood until a few days ago. This, he says, he certainly coughed up; that is, it did not come from the nose or stomach. He has recently had pain off and on under the midsternum. No emaciation or loss of weight. He coughed constantly while being examined.

His skin was fair, his hands cold, and his temperature 98° F. Chest was well developed, and no depression was noted on either side. Over the right apex anteriorly and posteriorly is heard a loud tubular expiratory sound, as well as a loud rough inspiratory sound approaching the tubular in character. Slightly impaired resonance over the right apex below the clavicle. Anteriorly over

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<sup>7</sup> The patient has recently returned to Philadelphia apparently cured.

the left apex a few crackling râles but no tubular breathing and no impairment of resonance. Vocal fremitus is not markedly greater on the right side than normal. Posteriorly over the right apex a few fine crackling râles, but over the left apex posteriorly no abnormalities could be detected. The remainder of the physical examination was negative, as was also the urine examination.

The sputum contained colonies of pneumococci and many fungi, but no tubercle bacilli and no elastic tissue.

The patient was last seen on February 1, 1904. His sputum had been less characteristic, thinner, and had contained no blood. Only over the two apices were the râles still present. Over the right apex were distinct signs of a catarrhal localized change, as well as of some consolidation. The temperature was again subnormal.

CASE XII.—E. H. is also a young man and a student, aged 20 years. There has never been a case of tuberculosis in his family history. He has always been well until during the last few years he has had repeated attacks of tonsillitis. Has some cough off and on. Occasionally has night-sweats, sputum is constant, and occasionally there are streaks of red in the latter and in the handkerchief. His hands are very cold and blue. The skin of the face and chest is normal. Over the right apex anteriorly above and below the clavicle there was distinct tubular breathing. The percussion note on the right side was higher pitched and decidedly less resonant. The left apex was negative. Under both clavicles there was a depression which was more marked on the right side. In the vessels of the neck and over the aortic and pulmonary cartilages a rough short systolic murmur was heard, especially over the base and during an inspiration. Other sounds were clear. No arrhythmia. No valvular lesion evident. The temperature at time of visit 98.2° F., the pulse and respirations normal. The patient was advised that there was a slight involvement of his lung, but has not been seen by me since his first examination.

CASE XIII.—L. E. W., a young man, aged 19 years, has come recently to Philadelphia from the South. His father's sister died of phthisis, but this is the only known case in the family history. The patient has never been sick until recently, and came to me to consult with regard to a local dilatation of the temporal artery. For some time he has had a bulging over the left temple. No throbbing, but painful, especially when doing nightwork with the

eyes. Patient urinates very frequently. No edema, no dizziness. No night-sweats, no loss of weight (but no gain for over two years).

His hands were bluish and cold, his feet also cold but never swollen. On examination there was a shower of fine râles over the right apex. Whispered pectoriloquy was distinct anteriorly and posteriorly. The percussion note was distinctly impaired over the right apex. The left lung apparently was normal anteriorly. Posteriorly over the apex a few fine râles were detected.

On questioning the patient he stated that six months ago he took the sea trip from Philadelphia to Savannah, and was given, he thinks, the cabin just vacated by a tubercular patient who soon afterward died. The room was not disinfected before he occupied it. He has had no cough, no sputum, and would not have known of the pulmonary involvement had I not called his attention to it. His temperature was on the first occasion 99.2° F., and the same figure was registered on February 29, 1904, when the physical signs were also the same.

CASE XIV.—Miss E., aged 33 years, a trained nurse. One sister died of phthisis, one nephew of the same condition, but no other cases could be discovered in the family history on either side. She has been in the training-school for three months, and is always tired and dragged out. Now has (February 14, 1904) sore throat, is sore over the muscles and body generally, coughs continually, and has some pain under the sternum. Has never had a night-sweat. She has now no expectoration, her temperature is 99.4° F., and the pulse 90.

She is pale, anemic, and looks ill. Her chest is fairly well developed, but the right subclavicular region shows a slight depression. No difference in the percussion note except on held inspiration. Only a suspected difference in vocal fremitus. No râles evident anteriorly on either side. Posteriorly over the roots of both lungs, occasional fine crackling râles were heard. Over the right upper lobe posteriorly a constant friction sound and a few râles were heard along the spine of the scapula, almost over the shoulder and almost to the vertebral column. Whispered bronchophony was distinct over the extreme apex of the right lung, both anteriorly and posteriorly. Over the left upper lobe posteriorly only a few fine râles were heard, and no impairment of percussion resonance.

On February 22, 1904, I examined the patient with Dr. Westcott, and found the physical signs again as noted, the temperature being 98° F. She was placed in bed for a week, on forced feeding and free purgation, and has now gone to her home vastly improved, but with essentially the same physical signs. Her temperature showed a striking tendency to a subnormal curve.

CASE XV.—A physician, aged 34 years, came to me on February 26, 1904, complaining of constant pressure over his right chest and pain on coughing. His family history showed numerous cases of phthisis on both sides, recent and remote. He himself was well and strong as a child, but entered athletic contests against boys older and larger than himself in school, and soon became exhausted and run down, either post or propter hoc. Has for a long time shown a tendency to catch cold. Two years ago he began to have pain in the chest, to feel tired, and to cough frequently. These symptoms seemed to be relieved, though he has often felt discomfort under the sternum and in the right upper chest. Expectoration often is free, mucopurulent, but has never contained blood. Has had no night-sweats, has lost no weight. Now has cough only when he catches cold, little or no sputum, but has constant discomfort or pain, or both, under the sternum, and over the right upper lobe. Feels tired and not up to the mark. His chest is large and roomy, but over the right apex, above and below the clavicle, the development (rather the natural bulging) is not as full as on the left side, the lung evidently being not so well inflated. The percussion note is also higher pitched, and tactile fremitus decidedly increased. Whispered bronchophony is distinct. Anteriorly and posteriorly over the right apex a few fairly large crepitant râles are heard; also still fewer over the left apex, râles only being heard anteriorly in the angle formed by the clavicle and the sternum. On the left side whispered bronchophony cannot be obtained. The expiratory sound over the right apex is distinctly tubular. His temperature is 98° F., his pulse 84, and his respirations 20. On deep inspiration the patient indicates the right subclavicular region as the focus of pressure and the seat of pain.

As the foregoing cases present a number of features in common, including both subjective symptoms and physical signs, it is

my desire to collect the most trustworthy and constant and, in the reflected light of the clinical pictures, to fashion, if possible, a symptom-complex for incipient thoracic phthisis. In this term will be included tuberculosis of the lungs, of the bronchial tubes, and of the glands, occurring separately and together, but only in the clinically incipient stages of the disease.

#### NORMAL PHYSICAL SIGNS

In the normal chest *inspection* should determine a symmetry of the two sides of a degree compatible with the habit and occupation of the patient. Many right-handed men and women, I have observed, have a drooping right shoulder, although the right chest is often more fully developed than the left. On account of the droop (due to many causes—to none more frequently than the posture assumed in sitting) there is often present a slight depression in an otherwise normal humeroclavicular space, if a new term may be coined to describe the angle formed by the head of the humerus and the clavicle. A depression in such a normal chest, therefore, need not necessarily be considered a sign of a pathologic condition. It will be found in many more women than men, as will be shown later, probably as the result of their sedentary life and sitting posture. Thin persons, of course, often present distinct fossæ above and below both clavicles. My reference, however, is to such depressions as are noticeable because occurring on only one side. I have seen this same shoulder-droop cause a slight hollowing over the suprascapular area. Every person with a normal chest can raise a drooping shoulder to its proper level when directed by the physician and such depressions are at once caused to disappear by this procedure.

The expansion of the two sides of a normal chest should be similar, if not strictly equal. In a right-handed blacksmith the right chest will not only swell farther anteriorly and posteriorly on forced inspiration than the left but will bulge higher and fuller above the clavicles, and yet both sides may still be normal. The rule, however, holds good, that even in such cases, in order to be called normal, the character of the expansion must be free and complete on both sides. The excursion of the diaphragm may be noted by watching the play of the muscles attached to the ribs and along the intercostal spaces. This excursion should be equal



or nearly so on the two sides. Difficulties arise, for example, in cases of phthisinoid chest, or in emphysematoid chests, with poor expansion on both sides; in such cases sometimes a slight difference will direct the attention to an abnormal condition. The nature and the extent of the expansion, therefore, form very important points of diagnosis between a healthy and a diseased lung, and in localizing the lesion.

The trained eye will pass instinctively from the pulmonary expansion to the apex beat, which in the normal chest has its approximately fixed position and character, which vary in no condition more than in the progressive changes of tubercular disease.

The skin of the body, including the hands and feet, should be of a healthy color and should nowhere indicate a lack of oxygen.

*Palpation* should yield at every point on the right side a more distinct tactile fremitus, as the result of the voice vibrations, than on the left. This difference is especially marked below the right clavicle, owing to the higher position of the right lung, the higher relative and actual position of the right main bronchus, its greater size, and, in right-handed persons, to the greater development of air-space on the right side. This difference is evident posteriorly as well as anteriorly, and over the entire superficial lung. In palpation, as well as inspection, and, in fact, in every step of physical examination, careful and critical results can be obtained only by comparing the findings upon one side of the chest with those of the other at an identical location. The reason for this fact is so obvious as not to require detailed mention. There is no cardinal rule so often violated, however, by the skilled and careless alike. In the same way, palpation should be carried out on the two sides with the same hand, since probably no two hands have palms and fingers of the same degree of sensitiveness. The lightest firm touch should be employed, and sometimes results can be obtained by palpating with the fingers alone or with the ulnar instead of the palmar surface.

*Percussion* yields, for the same reasons as have been cited in considering palpation, at many points a slightly better and fuller resonance and sometimes of a slightly lower pitch on the right side. At almost every point, except below the clavicles, there is more air-space under the finger or the pleximeter than at a similar point on the left side. Probably in the majority of cases the subclavicular

region on the right side yields a note that is at the same time less full and less resonant and slightly higher pitched than on the left, owing to the presence of the underlying vessels, the vena cava and the innominate. In many instances no difference can be distinguished between the two sides, the percussion note on both being clear and resonant. In a left-handed man the greater development of the left side tends to equalize the higher position of the right lung and the consequently greater (relatively) air volume at the given point. These relations hold good during forced and held inspiration and expiration as well as during the simple and natural breathing processes. The significance of the statement will be emphasized at a later point in our discussion of the pathologic condition.

As the pitch of the note has in many cases a greater significance even than has the volume and resonance, the necessity of comparing similar points on the two sides should again be emphasized. The difference in favor of one or the other side can be demonstrated so much more satisfactorily with the plexor and pleximeter that I have in my own work relegated finger percussion to secondary importance in examining the chest. The latter method is always valuable in demonstrating the resistance of a consolidation or of fluids; though the same results can be even better obtained by the use of the hammer upon the finger as a pleximeter.

Auscultation will, no doubt, always be considered the mainstay of the examiner in his study of the air-passages. It is none the less the procedure which is least intelligently practised by the average medical man, and its results are most often misinterpreted. Again identical points on the two sides of the chest should be examined with the ear on the bare skin, if possible, whether the patient be a man or a woman. Many women will object to what they term "an unnecessary exposure" until the possibility of phthisis enters their minds, whereupon every available covering is removed at the suggestion of the physician. In a number of cases in the present series the tubercular process had been overlooked by men of good standing, because of an imperfect examination the result of laziness or a sense of false modesty. In a number of the cases the process was finally discovered by the writer only because of a routine examination of the chest, the patient having requested treatment for an entirely different and usually trifling condition. In Case V

I failed to detect an early tuberculous process when compelled to examine through a night-dress and undergarment; but detected it with certainty ten days later when I insisted on examining the bare chest. Fine variations from the normal are distinguishable only under perfect conditions, and no ear can be expected to differentiate between the sounds of an early catarrhal process and the rustling of muslin or of silk over the skin.

Over the normal lung, with the ear on the chest, and also through the stethoscope, the breath sounds will appear as soft and undisturbed as the summer air. The stethoscope transmits a slightly harsher and more tubular sound to the ear, as well as one that is more intense. This is sometimes an advantage, sometimes a detriment. Normally the inspiratory sound, since it is the result of an effort, is heard throughout the whole of the inspiratory act. Expiration is simply a relaxation of the elastic vesicles, and is barely heard, sometimes being detected only by the closest attention. On forced respiration both the inspiratory and expiratory sounds are plainly heard, are harsher, more of the bronchial or tubular element blends with the vesicular, and more of the expiratory sound, therefore, becomes evident to the ear. In natural conditions inspiration appears to the ear to last four times as long as expiration. In forced respiration this becomes a less accurate comparison, and often the inspiratory and expiratory sounds are of equal length. At least five times out of ten, the careless examiner elicits forced respiratory sounds, and rates them as normal. Perhaps the best description of the normal pulmonary breath sounds heard on auscultation is implied in the word "soft."

As soon as there is a diminution in the respiratory sound, or as soon as a roughness is detected, with a lengthening of the natural expiratory sound, at that moment a pathologic process of some order may be suspected. The addition of a tubular element, of even the slightest friction rub, of râles however fine, make only more certain the suspicion that all is not right in the lung or its bronchi. Finally, I have noted in so many seemingly normal chests a sound that is apparently not an index of a pathologic process, and yet from its position and from its similarity to another definitely pathologic sound, may lead to error. In a large number of young men, with apparently healthy chests, I have heard, usually along the base of the heart, in or about the left midclavicular line,

a sound simulating a soft friction rub, if these two contradictory terms may be allowed to qualify one another. This sound has invariably been synchronous with the systole of the heart, and has been heard only during inspiration. It has become a habit with me to expect to find it in strong healthy young men, with well developed air-space and an active heart. I presume, through lack of a better explanation, it is caused by a friction between a healthy pleura and pericardium, brought into close apposition at that point during the inflation of the lung. In every instance it has been noted in a case that has lacked absolutely the history of pulmonary or pleuritic pain or inflammation, and the sound has always appeared to be too soft in character to represent an old lesion of the serous surfaces.

#### PATHOLOGIC CHANGES

The pathologic conditions, whether of the lungs, the bronchi, or the glands, in incipient tuberculosis, may be epitomized in the two general terms, *congestion* and *beginning consolidation*.

Probably no one has even seen under the microscope the earliest changes in a previously healthy lung. The avenue of infection, however, undoubtedly has much to do with the extent of the process at the time when symptoms are prominent enough to suggest an unusually thorough examination. Usually at this time the lesion, while we still rightly term it incipient, has existed for weeks and perhaps months or even years (as in Case IV). If the infection takes place through the blood or the lymph vessels the first lesion (in adults generally in or near the right apex) is one of slight congestion, due simply and solely to cold, exposure, or exhaustion, or perhaps to a family predisposition, of which we shall say more hereafter. No matter how healthy the patient in appearance when first seen, we may rest assured that there has been some antedating lesion which offered a favorable nidus, first, for the infection, then for growth and multiplication of the tubercle bacillus. No doubt, the first effect of the bacillus is irritative, the influence being exerted upon the blood-vessels which become overful and distended as in any other inflammatory center. The air-vesicles must soon suffer from this congestion, both as the result of pressure, because of obstruction to the venous outflow, and because of the direct influence of the poison elaborated by the bacillus, which is without

question invariably present at the site of infection. Often there are isolated areas of pleurisy at the bases or at any possible point over the surface of the lung. Wherever there is such a point of tubercular inflammation as the latter, or such as the congested vesicles, there will be collected broken-down and proliferated epithelial cells, blood-corpuscles, and leukocytes. These still further impede the circulation of and around the vesicles, and furnish in themselves a most favorable culture medium for the bacilli.

If the process commences in or near a bronchus it may be confined to the bronchial tube or its immediate adjacent area. Such cases are occasionally noted, in which all physical signs fail, and in which sometimes the sputum is swarming with tubercle bacilli.

A gradual increase in the deposit of this collection of blood, epithelium, and leukocytes forms little by little the beginning consolidation which soon demonstrates its presence by means of characteristic physical signs. The current name for this process is the stage of tubercle formation.

There is undoubtedly, and in every case, a time when there are only catarrhal changes present. I have examined many cases which I believe to have been of such a nature, and later, in an instance or two (*vide* Case X), have been forced to watch the consolidation develop. In Case X, indeed, a time can be fixed during which the physical signs changed from those of a normal chest to those of an active involvement. Early changes in the glands must also be those of congestion, and, immediately thereafter, hyperplasia and swelling.

When the lesion has advanced beyond these simple primary conditions the case has already passed out of the category of incipient tuberculosis.

#### PHYSICAL SIGNS OF INCIPIENT TUBERCULOSIS

It is my firm belief that with the veriest beginning of a superficial pulmonary tubercular process, physical signs are presented which may always be detected by a careful and trained observer. It is my equally positive conviction that at the present time in nine cases out of ten the earliest signs are overlooked, and that heretofore we have allowed discoverable indications to stare us out of countenance. In the case of a tubercular process located in the bronchi and the bronchial subdivisions, there are probably no dis-

tinctive physical signs. My only excuse for considering such cases here is to emphasize the fact that a patient may indeed suffer from such forms of tuberculosis, and have tubercle bacilli in the sputum, and yet have a symptomless chest. The same statement may be made regarding tuberculosis of the thoracic glands, though at times dulness may be elicited along the spinal gutter and beneath the manubrium, and sometimes an embarrassment of respiration will be noted, which seems to be due to the pressure of a mass upon the respiratory apparatus. It is a not infrequent thing to find at autopsy the bronchial glands involved, and no other apparent focus of infection.

In considering the physical signs, therefore, of a beginning thoracic tuberculosis, our study is limited to a great extent, after all, to the lesions of incipient pulmonary phthisis. The conclusions reached at this time are based, first, upon a series of careful observations made in the cases presented in this paper, all of which were seen in the early stages. None of these has up to the present moment progressed beyond the incipient stage, and all appear to be convalescent, the active signs gradually lessening in number and distinctness. Secondly, there have been included the results of a study of 71 cases of tuberculosis in all stages in the wards of the Philadelphia Hospital. In the latter series the physical signs in the lung secondarily involved (this occurring soon or later in every case) were observed with particular reference to the nature of the lesion probably present. Lastly have been included, though not mentioned in the statistical report, a number of isolated cases of incipient tuberculosis occurring in students of the University of Pennsylvania and in several nurses examined at three hospitals. Many other cases have been studied since the body of this paper was prepared to which no reference is made.

It is my earnest belief, and one which I see trampled upon every day by our foremost diagnosticians, that there is no one capable of making a thorough and scientific examination of the chest without a complete baring of the skin surface over the part to be examined. I may also say that I have never met with a refusal to expose the skin surface in man, woman, or child after I have explained that only in this way can the examiner be sure of his results or a trustworthy statement of the condition be ventured. I have seen others pass a patient by with the statement

that the lungs were normal, and have myself thought their judgment correct until I proved them and myself wrong after a removal of the clothing. This point is emphasized here because I believe not only that in its observance rests the possibility of the earliest diagnosis of incipient phthisis, but because I frequently see patients who have been examined by other men through shirts, dresses, or underclothing, and sometimes all three. A diagnosis based on such an examination may sometimes be correct and sometimes incorrect, but it is always unwarranted on the premises.

*Inspection* yields important data, which will be briefly referred to. The general conformation of the face, neck, and chest is very important. A thin, pallid subject, with dilated veins, with deep fossæ above and below the clavicles, with winged scapulæ (a so-called phthisinoid chest), and little or no pulmonary expansion invites the diagnosis of phthisis, and often thus invites a positive error. None the less, the picture is suggestive, and the further examination often shows sooner or later, if not at once, characteristic signs of the diseases. Cold hands and feet (also often cyanotic), clubbed fingers (more often seen in advanced processes), mouth breathing, a rapid apex beat, and sometimes nodular swellings in the cervical region, all are landmarks, and all add to the probability of present or future tubercular involvement of some nature.

Far more frequently a subject appears to the casual observer to be in the bloom of health, with no abnormal physical signs obvious to inspection. Such a patient may still be tubercular. Let me say, however, that when such patients are indeed tuberculous they always present physical signs suggestive, at least, to careful inspection. With very few exceptions the series of private patients presented in this study appeared thoroughly healthy to the eyes of their friends and sometimes of their families.

When a difference can be noted between the expansile powers of the pulmonary chest areas (right and left), we have at once a more positive object for our attention. Mensuration will confirm the suspicion suggested by the eye. The expansion over an abnormal lobe is never as free as over the healthy side. The apical swelling on deep inspiration is seldom as full. Especially in women in whom the costal type of breathing is normal is a diminution in the chest play suggestive. Exceedingly often there is a

depression above or below (or both) one clavicle only. The difference between the supra- and infraclavicular fossæ of the two sides becomes more certain during a full inspiration, and the play of the diaphragm (often evident to the eye) is usually less on the affected side. This test may be confirmed by means of the fluoroscope. Sometimes a depression may represent a retraction of the chest wall at that point; but much more often it is a sign of some condition which prevents inflation of the lung. This condition is frequently enough a tubercular process to render it a sign of value in the diagnosis of tubercular disease.

Sometimes, as already noted, nearly all of these signs are absent, and there seems to be next to no abnormality evident to the eye. Let me again say here, however, that I have never seen a case of incipient phthisis without a clamminess of the hands that invites attention; and that I have never seen a case of apical involvement in which after three or four active forced respirations, the abnormal apex did not fail to expand equally with its more normal fellow, and in such a way as to render the difference in the motion of the two halves of the chest evident to the eye. A localized decrease in expansion suggests at once a circumscribed involvement of the lung or pleura. Neither of these signs is pathognomonic of pulmonary phthisis; both suggest a careful study of the lungs from the apex to the base. In no branch of physical diagnosis is a careful comparison of the two sides at every point so imperative nor so often omitted. Nor is inspection complete without a careful view of the rectum. A fissure or a fistula or a rectal ulcer is highly suggestive of a tubercular focus elsewhere in the body, and most frequently in the lung. Careful inspection is of course impossible through clothing of any description whatsoever.

*Palpation* confirms the difference in expansile power between the two chests, and if the sense of touch is delicate it affords even more positive results than does the eye. Only when the two sides are compared is the procedure of any value. The frequent cyanosis and coldness of the extremities has already been noted under inspection, and the lack of circulation is again determined by the touch of the examiner.

Sometimes a difference can be noted in the transmission of the vocal fremitus to the hand (tactile fremitus) on the two sides.



The degree of difference depends entirely upon the extent to which consolidation has progressed, and in the earliest stages is not to be detected. As the air-vesicles gradually fill, the fremitus over the affected area becomes relatively more and more distinct, until there is no mistaking the pathologic character of the sign. It must always be remembered that the greater portion and usually all of the right upper lobe, and sometimes the entire right lung, normally yields a more distinct fremitus than the left.<sup>8</sup> During the stage of moist congestion, just as in some pneumonias, the fremitus becomes less evident, to become more marked again as true consolidation begins. When a pathologic involvement is suspected on the right side, care is required in order to avoid confusing the normal relative difference, with a pathologic intensification of the fremitus. When the fremitus is more distinct on the left side, there is no mistaking the suggestiveness of the occurrence, unless the patient be left-handed. In the latter event the over-development of the left side will vitiate the value of the increase in intensity.

Palpation, also, is of little value in the early stages of pulmonary phthisis, unless the hand can act upon the bare skin, by way of confirming, and often in conjunction and synchronously with, the eye.

*Percussion*, if rightly employed, often renders valuable aid in detecting incipient pulmonary changes. If carelessly or unintelligently used, it is very disappointing. As already stated, I have myself obtained much more satisfactory results in the use of *both* the finger-percussion and of a plexor and ivory pleximeter, the sharp note of the latter often giving definite information when the blunt finger note has failed. Da Costa's method of comparing the percussion notes obtained over the two apices during a held, forced inspiration, and then, after a rest, during forced expiration, often yields differential results that cannot be obtained during ordinary respiratory conditions. Again, a careful comparison of the note obtained in identical positions on the two chests is absolutely necessary in the use of the ivory pleximeter. The latter must not only be held in the same relative position, but the blow should be of

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<sup>8</sup> This statement has recently been contradicted by a prominent writer upon physical diagnosis. I regret that I must think him mistaken in his belief.

as nearly similar force as possible. Often there is a difference only in the pitch of the note, both the finger and the ivory yielding a higher pitch over the area of involvement. In the earliest incipency absolutely no difference can be detected. Only seldom can the finger detect early differences in the resistance of the tissues. Long before there is present on either side, however, the note that is ordinarily considered characteristic of a consolidation there can be detected by the careful ear an abnormal difference between the pitch and resonance of the notes on the two sides.

Once more, let it be remembered that on the right side (except in the apical region) the normal note is slightly fuller and lower in pitch than at the same point (all conditions being the same, such as underlying organs, etc.), on the left chest. The same exception is to be made with regard to the subclavicular areas, as has already been noted in the normal chest. As soon as the air-vesicles begin to fill with semifluid and then with semisolid and solid deposits, the pitch of the note obtained thereover becomes higher and the resonance more and more impaired. It seems hardly necessary to state that only a very clumsy percussion is possible through clothing of any thickness, and careful percussion is only possible over the bare skin.

*Auscultation*, after all, must be largely depended upon to render the diagnosis possible. Inspection, palpation, and percussion may all suggest a beginning tubercular process in the lungs, but if auscultation fails to confirm their evidence the latter must be set aside. Many women, for instance, have poorly developed right or left chests, fewer men, by far. Many, as a consequence, present signs suggestive, on inspection and palpation and percussion, of curtailed pulmonary motion and space. Fortunately, however, there are signs very early evident to the careful ear in every case of incipient pulmonary tuberculosis; and these signs, whenever found in a chest, are at once suggestive, and when in association with other signs and a suspicious clinical history, are often absolutely conclusive. Only three conditions, to my knowledge, simulate the early auscultatory signs of pulmonary tuberculosis,—influenza, syphilis, and the rare actinomycosis. When these can be excluded, a positive diagnosis of tuberculosis can be made.

Again, it is necessary to say that in order to obtain satisfactory and accurate results, the chest must be bare and the ear trained and

acute. Probably the first change that is noted is a diminution, or (its opposite) a harshness, of the inspiratory sound, as compared with that of the well side, or still better, that of any normal portion of the lung. Normal respiratory sounds, I have already said, are always soft. As soon as this softness of the breath sounds disappears, and whenever the sounds diminish in activity, pathologic involvement must be suspected. The next suspicious change consists in a lengthening of the expiratory sound, at first very slight, but later such as to render it even longer at times than the sound of inspiration. The personal equation is vital here, but there is no one who cannot train his ear (provided he has an ear) to detect the lengthening of the expiratory sound, when it becomes nearly or quite equal in length to that of inspiration. As the vesicles begin to fill, and breathing is attempted throughout the involved area more and more through the bronchial subdivisions, and less and less through the vesicles, if the breath sounds are still evident, first the expiratory and soon the inspiratory sound becomes tubular in character. It may very early be even distinctly tubular provided the process is a rapid one. This change in the breath sounds is, as a rule, to be noted first posteriorly over the apex of the lung, near the inner angle of the scapula; only later is it heard anteriorly and below the clavicle. In occasional instances this order of appearance is transposed, and the change is first heard anteriorly. It may, indeed, occur first at any point over the pulmonary surface. *It must not be confounded with the breath sounds which are normally tubular in a small number of chests; nor with those heard normally over the superficial bronchi.* The blowing or tubular breathing of incipient phthisis is heard only over the small area of involvement; it is never transmitted to any considerable distance; it is often detected only upon comparison of the two sides of the chest. It is only *suggestive* in character.

As soon as the stage of consolidation is approached, the sound of the spoken voice is transmitted with great distinctness to the ear. Especially the whispered speech is carried with vividness, in the entire absence of a cavity. This sign is of double value when the two sides of the chest are compared, as it is never presented by normal tissues. Moreover, it is never simulated over the apex of the lung by other than a pathologic condition. I have recently observed it in an incipient case (XIII) which, up to the

present time, has been troubled neither with cough nor with expectoration. Still more important than the foregoing, which may sometimes mark a healed pulmonary lesion, and very suggestive, will be the discovery of fine hair-crackling râles. These are often obtainable only after a cough, are usually heard first posteriorly over the extreme apex, or along the spine of the scapula. Sometimes I have discovered them only in the axillary space, high up in the armpit. Such râles, when syphilis and influenza can be excluded, offer in most cases the first positive signs of phthisis. If these fine râles, which will never be forgotten when once heard, and resemble closely those of an early croupous pneumonia, occur on only one side of the chest, and over a small area, the exclusion of syphilis and influenza becomes more and more possible. Usually also the râles of an influenzal pneumonic patch are larger and less characteristically crepitant. There is no more suggestive sign of incipient pulmonary phthisis than these localized fine râles, and to one who has seen many cases of early tubercular change, they are a dread omen of a long course of treatment and only a probable cure. Often a gentle friction rub accompanies, and sometimes is heard alone.

The subclavian murmur heard in the subclavicular spaces may be present in the relighting of arrested tuberculosis, and in advanced cases. It is due to the constricting force of adhesions.

A phenomenon has recently been described by Cybulski and favorably commented upon by Remouchamps which is also sometimes evident to the ear, and is caused by the same fine crepitant râles. I refer to a fine crepitation, described by Cybulski as similar to the scratching of a pen, and heard usually at the end of inspiration, with the listener's ear held close before the patient's open mouth. I have studied this so-called laryngeal crepitation in many cases, and have been able to obtain it in some incipient conditions, but have failed in the greater number. It appears to be present in many of the more advanced cases which show fairly loud subcrepitant râles near the bifurcation of the trachea; but is certainly not even a fairly constant sign of the early tubercular changes.

Attention may also be called to the fact that the heart sounds become plainer over an area of infiltration, and that this fact may aid in locating the lesion in an obscure case.

Also, auscultation over a suspected area when the handle end of a vibrating tuning-fork is caused to move over the skin surface will often detect the intensification of the musical note as the instrument passes over an area of congestion or semisolidity.

In commenting on the physical signs as discussed, I would say merely that they are first found in adults, as a rule, posteriorly over or near the pulmonary apex, usually the right. In children they are more frequently detected over the root of one lung, again usually on the right side. In both adults and children they may appear at any point over the pulmonary surface. I would again emphasize a cough as an important influence in rendering audible otherwise latent adventitious sounds. Many incipient cases present few indications, no case presents none. Even to the dull ear, after a time there will remain no doubt that something is wrong within.

#### THE CASE HISTORY

There are few conditions in which the case history may bear so much weight, and influence the diagnosis so positively, as in incipient phthisis. All particulars as to the family history should be searched for, and among the better classes many suggestive facts will be learned. Among the poorer classes the results are generally misleading. In both classes the observer will be surprised to learn in how many instances the tuberculosis was preceded by a tubercular ancestry, or by cardiac and renal disease in former members of the family circle. In the present series of fifteen cases, all from the middle and upper classes, all but four revealed instances of phthisis within two generations of the immediate family. In four of these cases tuberculosis occurred in one parent, in three in both parents, in two in one grandfather or grandmother only, and in two in a brother or sister (in one of the latter cases both the father and mother, and all the brothers and sisters were syphilitic). Against this record of tubercular ancestry obtained from patients who are qualified to know and to remember the facts regarding their families, we may contrast the results of questioning 71 cases in the wards of the Philadelphia Hospital, in only 20 of which could be obtained a suggestion of an antecedent family history of tuberculosis. In 24 of the cases the patient replied that tuberculosis had not occurred in the family, or else that "he had not heard of any." Many admitted that they did not know the facts.

In three cases the father had died of phthisis, in six the mother, in one a grandparent, in ten either a brother or sister or both, and in one case a wife. In one case four sisters and one brother had died of the disease, another brother having a chronic cough at the present time. In another instance the father died of phthisis, the mother of pneumonia, two brothers and two sisters of phthisis, and one or more uncles on the father's side of the same disease. This patient had been "delicate" (to use his own expression) all his life.

There seems to be a tendency (Flick and other students to the contrary notwithstanding) for the pendulum to swing back toward the theory of occasional direct hereditary transmission. The more I study the chest the more I believe in a connection between the tuberculosis of the parent, or the grandparent, and physical degeneracy of the child. The personal history is of equal importance with the family history, and should date from childhood to the present illness. Antecedent infectious diseases, especially pneumonia, pleurisy, grippe, measles, typhoid fever, whooping cough, and syphilis, lend important evidence in the suspected case. A record of an intermittent cough of long standing, of dyspnea, cyanosis, cold extremities, of expectoration (with or without blood), fistula in ano, of loss of weight, of dyspepsia—one or a number of these symptoms in the history of the case will be of inestimable value. In a few cases night-sweats appear very early, and may either persist or disappear as the disease progresses. There may be slight discomfort or pain in either or both chests, and often under the sternum, as the most prominent symptom in the early course of the disease. No word need be said of the importance of obtaining a careful estimate of the patient's own idea of the beginning of the existing illness. A history of a constantly subnormal temperature is very suggestive of phthisis, and the patient can often advise the physician of the presence of a subnormal state without the use of the thermometer.

#### COUGH

Nearly every patient with incipient or advanced tuberculosis will describe a cough or a "cold" as the beginning of his illness, and this fact should teach us the importance of a careful physical examination in seemingly minor conditions. I have closely questioned 71 patients in the Philadelphia Hospital as to the first sign

noted by them of their present disease, and obtained from 64 the statement that they "caught cold," and could not get rid of the cough. Seven gave a history of a pneumonia, following which the cough never disappeared. All described a slight hack, or clearing of the throat, which in many became a hard cough. This early cough in some cases appeared to vanish for a time, and then to recur with redoubled activity. This was true in Case X of my first series, all cough disappearing for several months, only to reappear with the next cold. This was and is true also in Case I, there having been hardly a cough since January until the beginning of March. One patient in the Philadelphia Hospital, 48 years old, had coughed since childhood, and only eighteen months ago began to have active signs of phthisis. Another of 43 years had for three years a hard cough, and for twelve years had all the signs of phthisis. He recovered in Colorado, and for seven years had no cough. He then returned to the East, "caught cold," six months ago, and again has an active pulmonary process. Both of the latter patients were unusually intelligent men, and claimed to recollect distinctly their four grandparents and their parents, in none of whom had there been a case of phthisis, all dying of old age. In almost every case cough was the first symptom noted by the patient, and in no case did the patient believe he had more than a cold. In my first series of incipient cases 14 began with a slight but persistent cough.

I call attention to this symptom with a view to emphasizing the necessity of a careful examination of the bare chest in all cases of "simple cold," or "cough."

I believe that such a procedure will have more influence upon the disappearance of the disease than all the regulations passed and enforced by the most active and conscientious of Health Boards. In a case presenting a protracted cough, of undiscoverable origin, even if the chest shows no physical signs of disease, and the laryngologist can find no local cause, I believe it is imperative to look upon the patient as probably phthisical and either to institute a systematic course of hygienic treatment based on that theory, or to insist upon a series of frequent examinations of the general physical condition. Probably there are few cases of advanced phthisis to-day that have not at some time been looked upon as "bad

colds," when a routine careful study would have resulted in the institution of early treatment and frequent cure.

#### THE SPUTUM

Sputa may or may not be in evidence in the incipient case of tuberculosis of the lungs. In my series of cases eleven expectorated constantly a free secretion of mucopus. Three had no sputum except at times when ordinary "colds" were contracted. One had simply a postpharyngeal mucus which could never be obtained for examination. In the bronchial form of the disease the sputum is probably always profuse and almost from the beginning. In Case X it was rarely obtainable even in the smallest quantities, and then only at rare intervals. In Case IV considerable quantities of pus and blood were expectorated over a space of more than two years, and yet the pulmonary process had advanced so slowly as to cause a doubt in the mind of more than one student of his case as to the exact condition present. Usually the sputum resembles in all respects the yellow mucopus of a coryza or a simple bronchitis. More rarely it is streaked with blood. Usually it contains many colonies of diplococci, and often staphylococci, or streptococci, or all three. I always look upon the occurrence of tetragenii in the sputum as an incentive to examine more thoroughly for tubercle bacilli. The association is very frequent. Sometimes tubercle bacilli may be found. The most that can be said for the sputum of incipient pulmonary tuberculosis is that it is absolutely atypical unless it contain tubercle bacilli. It should be examined, and repeatedly as soon as there is sputum to examine. Elastic tissue is probably never to be found in the incipient case, and need hardly be anticipated.\* The sputum examined should be certainly that which comes from the chest cavity and not that which so often drops back and down from the nasopharynx during the night. The patient should be asked to secure that which is coughed up first in the morning after rising, and not the first clearing of the throat. If this rule is followed much more frequently will definite results be obtained.

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\* Since writing the above I have found elastic tissue and blood in the sputum of one clinically incipient case. In the same specimen a few atypical, but suspicious, bacilli were found.



## THE SIGNIFICANCE OF TUBERCLE BACILLI IN THE SPUTUM

A much mooted point is the significance of the bacilli in the sputum, and still more doubtful appears to be the import of their complete absence. In Case I the diagnosis was first postponed because bacilli could not be found, it was denied by the next consultant in spite of their positive presence, it was deemed improbable by the next because they had been found only occasionally, and the last consultant presumably attached no importance to either their presence or absence. In the first place I would say that I have seen exceedingly few cases of pulmonary tuberculosis in which tubercle bacilli have not been found sooner or later, provided sputum has been present. Such cases undoubtedly do occur, and there are several included in my series. I have seen many cases in which the sputum was examined in an incomplete and unscientific manner with a negative result, and yet the bacilli were demonstrated by a more systematic procedure from the same specimen. Many such cases will reveal the fact that one or two or three specimens have been examined, often only one smear from each, and often in a far from thorough manner. If it is worth our while to make the diagnosis it is highly important that we prove our ground. In Case IV nearly 100 specimens were stained and examined. In the twenty-first and twenty-second of my own preparations, in only one of a series studied by another examiner, and in none of a long series prepared by a third were tubercle bacilli found. In nearly every case cited in this series many specimens of sputum showed not a single tubercle bacillus. In nearly all a few bacilli were found sooner or later. In one (Case III) no bacilli could be found on one occasion, and then weeks later the sputum was swarming with them. In Case X no sputum could be obtained; and in Case IX, though the sputum was profuse and constantly streaked with blood, not one tubercle bacillus could ever be discovered. The latter patient left for the West before an exhaustive study of the sputum could be carried out.

These facts based on actual cases, together with many interesting experiences in the examination of sputum for other observers in the past, have forced me to formulate the following conclusions:

(1) Only repeated and systematic examinations of the sputum constitute a careful and conclusive study. A failure to find tubercle bacilli in one specimen has practically no significance.

(2) Only fresh sputum is likely to yield bacilli when they occur in small numbers. My experience in this regard is contrary to the usual statement, but is based on many cases and special study of the point in question.

(3) Bacilli, though actively at work in the pulmonary tissues, may occasionally be found in no other portion of the sputum than the so-called "caseous bodies," and may not be found in these.

(4) Tubercle bacilli may be only intermittently present in the sputum of a tubercular patient. The search, often otherwise unsuccessful, may be rewarded after centrifugating the sputum and examining the precipitated particles.

(5) If no bacilli can be detected by the ordinary methods inoculation experiments may prove their presence. Inoculation experiments must be repeated more than once before the absence of bacilli can be assumed.

(6) Both staining methods and inoculation experiments may be carried out and still no bacilli be found; yet the patient may be the subject of incipient phthisis, and later demonstrate this fact by progressing into the advanced stages of the disease.

(7) Probably in rare instances tubercle bacilli are found in small numbers by ordinary staining methods in the sputum of normal subjects in ordinary daily life. This has never occurred in my experience, and must be an exceedingly infrequent happening.

(8) The presence of a few tubercle bacilli in the sputum must be looked upon as confirmatory of suspicious or definite physical signs. In the total absence of characteristic physical signs, large numbers of bacilli in the sputum usually point to a purely bronchial form of the disease.

(9) Only in the complete absence of physical and subjective clinical signs should the occurrence of a few tubercle bacilli in the sputum be minimized. As this coincidence of conditions probably never suggests an examination of the sputum, the circumstance will probably never arise, and probably never has arisen, in which it will be warrantable to set aside the discovery of the bacilli as having no bearing on the case.

(10) Typical, as well as branched, and other atypical forms of the tubercle bacillus, may occasionally be found in the sputum of incipient phthisis. The most common atypical forms are short, thin rods, non-beaded, but staining characteristically, and both acid-fast and alcohol-fast.

(11) Tubercle bacilli should not be looked upon as a customary finding in incipient phthisis. When present they practically determine the diagnosis.

#### EMACIATION. LOSS OF WEIGHT

Of my series of cases eleven out of fifteen showed a noticeable loss of weight. The physical condition of the patient, however, seems to vary almost as much with the individual as with the degree of advancement of the process. I have seen a case of undoubted incipient tuberculosis (Case VII) gain steadily in weight from the time overful nourishment was begun until the statement was made that the case was one of phthisis, whereupon the weight was gradually lost to the original figure. It is a mistaken idea that because a patient gains in weight and appearance under simple treatment the diagnosis of incipient tuberculosis has been improperly made. Certain subjects may even recover, and undoubtedly do, in spite of altogether unfavorable hygienic surroundings. Most patients, however, do not.

As a rule, in the early case, there is no emaciation and no loss of weight. Often the figure is of ample proportions, and many times I have heard the laity exclaim, "To think of one in the picture of health getting consumption!" At times it would appear as though the strongest and heartiest men and women were chosen. Sometimes, however, the history will be elicited of a longstanding cold, and a gradual loss of weight and strength. In such cases the patient will make the diagnosis for the physician, and does not need his assistance except for the purpose of treatment. We must not forget the fact that incipient tuberculosis implies a beginning infection of the system only, and that it is too early for most cases to show the deleterious effects of the poison.

#### THE TEMPERATURE

Contrary to the usual opinion, current even among medical men, I have found the temperature is in the great majority of instances of truly incipient tuberculosis a subnormal one. Even in such cases as show a slight afternoon rise the chart, as a rule, demonstrates the fact conclusively that there is an almost constant tendency toward a point below the normal line. The charts of Cases I, VII, and X of my series of private patients illustrate this

tendency in cases with slight occasional febrile rises. I have watched a considerable number of cases for months, and have requested these patients to use the thermometer systematically at specified times in the day, and have found the record throughout weeks and months below the normal line, rarely as low as  $96^{\circ}$  F., more frequently  $97^{\circ}$  F., and usually varying during the day from a point somewhere between  $97^{\circ}$  and  $98^{\circ}$  F. to  $98.4^{\circ}$  F. or slightly (one or two tenths or more) above. In my present series of incipient cases 13 showed an almost constantly subnormal temperature, and two a temperature varying between  $98^{\circ}$  and  $103^{\circ}$  F., usually below  $99^{\circ}$  F. Even in advanced phthisis  $96^{\circ}$  F. is a common reading for the morning temperature. Occasionally, it must be admitted, the temperature assumes from the very beginning the slight afternoon febrile type. Case VIII showed the accompanying febrile curve for more than a month (perhaps much longer) prior to the discovery of the pulmonary lesion. The accuracy of the temperature study depends largely upon the frequency of the observations, and especially upon the time of the latter. Usually the febrile rise, if any be present, occurs between 4 and 5 P.M. Sometimes, however, it appears as early as 3 P.M., and often as late as 6 or even 8 P.M. The time of this rise must be carefully ascertained, and the observations made with reference to it. The same precaution is necessary in ascertaining the minimum morning temperature, though this is noted far more constantly between the hours of 7 and 8 A.M. As soon as mixed infection is well under way, and when there is evidence of general tubercular poisoning, and when actual tissue destruction begins, fever makes its appearance. Even at such a time the subnormal temperature usually persists in the morning, while the late afternoon or evening record is from one to three degrees or more higher. Often the patient will call attention to the low temperature of the body by saying that he is never warm. Case X made the remark to me that "people did not like to shake hands with her, her hands were so cold." In this series of 15 incipient cases all but 2, as already stated, presented a subnormal temperature throughout the greater portions of time they were under my care, except under certain temporary inflammatory conditions. Of 71 patients in the Philadelphia Hospital with phthisis of varying degrees of advancement, there was not one that failed to show a subnormal temperature during most mornings, no

matter how high the afternoon reading rose (sometimes  $103^{\circ}$ – $104^{\circ}$  F.). Often the morning temperature averaged  $96^{\circ}$  F., and usually was below  $97.5^{\circ}$  F. The average minimum temperature for the entire series was  $96.5^{\circ}$  F., and the average maximum  $100.6^{\circ}$  F.

#### THE PULSE

The pulse in incipient phthisis will be found to vary little from the normal. In one only of the cases of this series (Case IX) was the circulatory action suggestive of a toxemia. This patient averaged a pulse-rate of over 110. In most cases, in character, rhythm, and rate, there will be nothing to suggest that the patient is suffering from either a pulmonary or a circulatory disease. Nearly all patients show a tendency to a slight tachycardia upon exertion, especially upon climbing stairs. Hurry or excitement also seems to excite a cardiac action noticeable to the patient as "thumping" in character. A number of my patients (12 out of the present 15) have volunteered this information.

#### THE RESPIRATIONS

It is also true of the respiratory action that little variation from the normal is to be noted by either the patient or the examiner until the disease is well under way. In most of the cases of the present series the respiratory rate was normal. Occasionally I obtained the information that the patient was short of breath on exertion, again upon climbing stairs, etc., but usually this was qualified with the remark that the dyspnea was "no more than most people had."

In a number of cases observed since my attention was first called to the subject, the expansion of the chest during ordinary (natural) inspiration was astonishingly good. With the slightest consolidation the respiratory rate is quickened, however so slightly, and with beginning cardiac embarrassment comes also a corresponding effort at respiratory overwork.

In active and advanced phthisis the respirations vary markedly in rate per minute, the Philadelphia Hospital series averaging 27, the minimum and maximum averages being 22 and 32. A few cases varied from 18 to 40 respirations to the minute at different times in the same record.

The cogwheel, or jerky type of respiration, so typical of the advanced stages of phthisis, is probably seldom seen in the truly

incipient processes, and is noted in so many other thoracic conditions (among others, cardiac dilatation) that it should be looked upon as suggestive only. The following table, representing the minimum and maximum temperature, pulse and respiratory rate of the advanced cases furnishes an interesting series of figures.

Case.	TEMPERATURE.		PULSE.		RESPIRATIONS.	
	Min.	Max.	Min.	Max.	Min.	Max.
I. . . . .	97°	101.4° F.	72	104	20	28
II. . . . .	97°	101.1°	88	120	16	24
III. . . . .	97°	99°	62	80	20	24
IV. . . . .	96°	101.3°	72	108	26	38
V. . . . .	96°	101°	80	124	26	52
VI. . . . .	96°	100.3°	80	112	20	26
VII. . . . .	99°	103°	98	122	23	37
VIII. . . . .	97.2°	99°	80	90	22	28
IX. . . . .	97.3°	103°	80	100	27	30
X. . . . .	98°	100°	82	90	25	32
XI. . . . .	97°	102°	90	118	23	42
XII. . . . .	96°	100°	72	90	20	30
XIII. . . . .	96°	99.4°	84	110	20	38
XIV. . . . .	96°	100.3°	72	100	20	30
XV. . . . .	96°	102.3°	80	106	23	35
XVI. . . . .	97°	99.1°	60	96	18	28
XVII. . . . .	96°	99.1°	68	102	20	29
XVIII. . . . .	96°	100.3°	60	100	22	30
XIX. . . . .	97.3°	100°	76	110	20	28
XX. . . . .	97.2°	99.2°	72	92	20	28
XXI. . . . .	100°	102°	90	100	20	25
XXII. . . . .	98.2°	99°	80	100	24	28
XXIII. . . . .	97.2°	102°	72	120	20	40
XXIV. . . . .	98°	102°	75	112	24	31
XXV. . . . .	98°	100.4°	70	92	14	38
XXVI. . . . .	96.4°	101°	92	128	14	38
XXVII. . . . .	96°	101°	92	128	21	36
XXVIII. . . . .	96.4°	99°	92	104	22	40
XXIX. . . . .	99°	102°	95	122	28	38
XXX. . . . .	99°	104°	90	120	20	42
XXXI. . . . .	97°	102°	80	112	26	45
XXXII. . . . .	96.3°	99.4°	72	90	20	32
XXXIII. . . . .	97.3°	101°	80	112	22	35
XXXIV. . . . .	96°	101.3°	50	110	20	32
XXXV. . . . .	97.2°	101°	90	120	23	30
XXXVI. . . . .	98.2°	101.2°	82	102	23	30
XXXVII. . . . .	97.4°	90°	82	110	27	30
XXXVIII. . . . .	99°	101°	88	100	22	24
XXXIX. . . . .	96°	100°	72	100	20	30
XL. . . . .	98.2°	99.4°	70	84	19	28
XLI. . . . .	100°	102°	95	140	25	30
XLII. . . . .	96°	103.4°	72	100	18	36

Case.	TEMPERATURE.		PULSE. RESPIRATIONS.			
	Min.	Max.	Min.	Max.	Min.	Max.
XLIII . . . . .	96°	98°	80	88	24	30
XLIV . . . . .	98°	100°	100	120	30	45
XLV . . . . .	97°	99°	80	85	17	27
XLVI . . . . .	97°	101°	80	100	25	30
XLVII . . . . .	97°	99.2°	80	92	17	25
XLVIII . . . . .	96°	100°	92	120	20	28
XLIX . . . . .	97°	98°	70	80	18	20
L . . . . .	96.3°	100.1°	80	110	22	32
LI . . . . .	96°	100.2°	80	110	20	32
LII . . . . .	98.2°	99°	74	90	20	25
LIII . . . . .	96°	102.5°	90	100	16	34
LIV . . . . .	96°	103° (constant variation)	84	124	22	46
LV . . . . .	97°	101°	80	101	20	26
LVI . . . . .	96°	100.2°	72	100	22	30
LVII . . . . .	97°	99.2°	70	90	20	30
LVIII . . . . .	97°	101.3	88	112	20	28
LIX . . . . .	97.1°	99.3°	70	86	20	24
LX . . . . .	98.1°	99.2°	80	98	23	28
LXI . . . . .	91.2°	102°	98	120	20	36
LXII . . . . .	96.3°	98.2°	88	140	20	24
LXIII . . . . .	96.3°	100.2°	72	106	20	30
LXIV . . . . .	96°	102°	72	88	20	32
LXV . . . . .	97°	98.4°	70	82	27	30
LXVI . . . . .	96°	99.2°	60	102	18	27
LXVII . . . . .	96°	99.4°	72	102	20	30
LXVIII . . . . .	96°	100.2°	72	120	18	28
LXIX . . . . .	96.3°	100.2°	70	92	20	36
LXX . . . . .	97°	99.2°	80	84	24	36
LXXI . . . . .	96°	102.4°	100	140	20	40
Average . . . . .	96.5°	100.6° F.	79.1	106	22	32

## NIGHT-SWEATS

Overfree sweating during the night hours, or even in the day-time, may herald the oncoming disease. Usually, however, the tubercular process is well advanced in the lung before the patient complains of this symptom. In one case in the Philadelphia Hospital series profuse night-sweats formed the first symptom to appear after the cough, and have persisted ever since. Also in Case XII of my first series, occasional profuse night-sweating formed one of the few early symptoms of the disease. In only six of the series of 15 had night-sweats been noted up to the time the patients came under my care.

## PAIN

Many subjects of incipient tuberculosis will complain of pressure, or acute, fleeting pains, or of a dull ache, in one or the other

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(but always the affected) side of the chest. Often this discomfort is at first very slight, and is experienced mainly over the upper portion of the sternum. Usually the patient complains of "rheumatism in the shoulder." Often, however, pain is completely absent. When it does occur it becomes more noticeable on exertion, and when the patient is fatigued; often it again disappears with rest. Occasionally the discomfort is localized over one apex, and is then a positive help in the diagnosis. Several patients recently seen by me have described a pain, experienced on coughing, and localized in the right apical region; also a dull, heavy feeling over the same area when at rest. Only over this area were physical signs evident.

In 13 of the present series of 15 incipient cases pain, or at least discomfort, was experienced over the area of pulmonary involvement. In a young physician examined by me during the past few days, indefinite pain over the right upper lobe, especially on exertion, is the only subjective symptom.

#### THE DIGESTIVE TRACT

It is a common idea that the digestive tract is always affected early in the disease. Probably this is correct under the former meaning of the word "early." Of the present series of cases only four complained of marked digestive symptoms, and at least two of these might easily have explained the occurrence by independent causative conditions. In only six cases were there symptoms present at all ascribable to the digestive tract. In Case II the symptoms were typical of gastric ulcer, and were so persistent, while the pulmonary symptoms were so slight, that it is at least possible that an ulcer was present at or near the pylorus. In Case V the symptoms also suggested gastric ulcer, though much less strikingly. In both cases this diagnosis was considered alongside that of incipient phthisis, prior to the discovery of the pulmonary lesion. In Case X the symptoms which led the patient to ask for medical advice were typical of migraine, and consisted of headache, vomiting of bile, flashes of light before the eyes. The cough preceded these, but was so slight as to be overshadowed by the more troublesome ailment. Case I was characterized by vomiting every meal during the space of three weeks, and until she was placed in bed in my own house. She had lived in a young woman's boarding-house and had always found it hard to enjoy her food while there. The remaining



patients showed no digestive disturbances, though several had more advanced incipient lesions than the four preceding.

A very early sign of the oncoming digestive disturbances of phthisis, and one noted in a number of these cases (nearly all) is a peculiar garlicky odor of the breath, which I have come to regard as almost characteristic of the disease. It is not always present, even in advanced stages of the disease, but is so common a phenomenon as to be regarded as of distinct value in the diagnosis. I have seen no mention of this peculiarity in any of the descriptions of early phthisis. Of the series of 71 patients at the Philadelphia Hospital nearly all experienced digestive disturbances sooner or later. Of the entire number, however, only one remembered indigestion (gastric distress) as a very early symptom. Three patients advanced in the disease have never had any digestive disturbance. A few patients described dyspepsia as a complaint from which they had suffered all their lives.

#### HEMORRHAGE

Of all suggestive signs hemorrhage is at once the most striking, the most misleading, and the most often misunderstood. It should always attract the attention, whether a simple streak of red on the pocket handkerchief, or a basinful of blood. Any degree of bleeding, however, may be due to one of a dozen conditions other than phthisis pulmonum. On the other hand, as already mentioned, incipient phthisis may be ushered in by either a large hemorrhage or by a streaked sputum. By this I mean that either the patient or the physician may have his attention first attracted in this way. In few cases only, in which hemorrhage of any quantity has been noted, have I failed sooner or later to find physical signs in the chest that were suggestive, if not positive, and which must have existed for some time previously. None the less, certain conditions do indeed cause extensive hemorrhage from the mouth, and these must always be borne in mind. A case in point was a patient recently studied in the wards of the Philadelphia Hospital, who showed areas of consolidation over the lower and middle lobes of the right lung, and a profuse, constantly bloody expectoration. This patient, when placed empirically upon antisyphilitic treatment, rapidly recovered from all symptoms, the areas of consolidation in the lung disappeared, and there seemed to be no doubt as to the luetic origin of the pulmonary lesion.

On the other hand, Case II in my first series had two enormous hemorrhages as his first and only discoverable symptoms. Case III offers an instance of a large hemorrhage following, within three weeks, the discovery of a few râles in a supposedly healthy chest. Case V presents an example of a trace of red discovered upon the pocket handkerchief by her husband. Case V gave a history of constant blood-spitting for two years, with physical signs still insignificant at the time of my examination of him for a bad cold. Six of the series had never brought up blood from the lungs either in its free state or mixed with the sputum. My feeling with regard to the hemorrhage as a sign of incipient tuberculosis is that when present it is highly suggestive, but that when absent it violates no rule.

#### THE BLOOD

A careful study of the blood in a large number of cases has failed to show any indication of the early tubercular process. In most of the instances reported in this paper the hemoglobin was slightly reduced in quantity, and the red corpuscles in proportion. The leukocytes have shown practically no change, either in their total number or in their relative percentage. As compared with the physical signs and the subjective symptoms, the laboratory assistance in incipient tuberculosis as regards the blood study is of little value.

#### THE TUBERCULIN TEST

My own personal experience with the tuberculin test is slight, and I hesitate to base an opinion upon the small number of cases in which I have employed it as a diagnostic measure. In the light of our growing knowledge of the early signs of the tubercular disease, however, I feel that only in rare cases will its employment appear to be a necessity. In fact, I do not feel sure at the present moment that it is ever necessary in a case of pulmonary phthisis. That it is a safe procedure I think we must all begin to believe, provided it is carried out scientifically and according to the latest and approved methods. In early tuberculosis of the bronchi, in which there is an almost complete absence of suggestive physical signs; or in tuberculosis of the thoracic glands; or in tubercular involvement of other structures of the body, I am led to believe that its assistance may be invaluable. Trudeau employs it without hesitation in a doubtful case. In discussing its value and risk recently,

he referred me to the conclusions of Tinker, published in the Johns Hopkins Hospital Reports, 1903, based on 500 tuberculin injections in over 300 patients since October, 1900. Tinker concludes that the test is not only harmless, but that it is fairly reliable. Nearly all writers agree that not more than 10 milligrams should be employed at a dose, and that usually much less is required; also that a reaction to this maximum dose is frequent in healthy persons. Nearly all agree also that a temperature of 99° F. or over contraindicates the injection.

A number of writers note the reaction to tuberculin by patients with healed lesions. Many cases of syphilis also react. No doubt many of these seemingly non-tubercular cases are as a matter of fact the subject of latent processes. We must not forget the fact that a great number of seemingly healthy persons are tuberculous at some point at some time. Since it is impossible to speak first-hand on the matter I shall postpone original comment until I have had the opportunity personally to prove or disprove its merits to my own satisfaction. This I hope to be able to do in the near future.

#### THE SERUM REACTION

Arloing and Courmont and others have earnestly recommended the serum test as an aid in the diagnosis of tuberculosis. There has been much unfavorable criticism of their results, however, especially by Beck and Rabinowitch. Again, my own experience covers no cases upon which the procedure has been attempted. I must confess that in this disease, the outcome of which is so often distressing to the sufferer, I prefer to leave all questionable experimentation upon the tuberculous human subject to others of a more cold-blooded mould.

#### THE X-RAY

The x-ray offers, in the few cases in which it is necessary, remarkable confirmatory evidence of a beginning consolidation, and occasionally of the presence of old and quiescent tubercular foci in the same subject. It may also show a diminished excursion of the diaphragm on one side. In a doubtful case it should always be employed, though one must not be disappointed if the report reads, as so often is the case in Röntgen diagnosis, "the plate shows a slight shadow over the suspected area, but there is nothing definite enough to warrant a positive statement."

Here again I feel that in most instances the beginning process can be detected by other means prior to the stage of consolidation, and that both the public and the physician should be trained in the necessity of a study of the chest before the new disease has advanced so far as to render the x-ray even helpful.

I heard a physician say not long ago, "the men around me laugh at signs which I consider indicative of incipient tuberculosis." I do not wish to neglect any aid to a differential diagnosis, but in most cases would join with him in handing over the x-ray machine to the laughers, feeling sure that in time they, too, will depend far less upon its bulky uncertainty and more upon the ear, or the stethoscope, placed directly upon the skin surface of the bare chest.

#### OTHER SUGGESTIVE OR CONFIRMATORY SIGNS

In rare instances certain localized superficial lesions seem to precede the evident physical signs of pulmonary phthisis. Fistula in ano, in only one instance in the Philadelphia Hospital series of 71 cases, appeared to be the first symptom of the latent disease. In a second case it appeared soon after the cough. In a recent incipient case it was the first sign to be discovered. Adenitis, cervical or general, has been noted by a number of observers as a very early sign, though more often regarded as a mark of probable exemption from pulmonary involvement. In opposition to the popular attitude of the medical profession toward this glandular enlargement, especially when it is general, my own personal feeling is that it is a focus of tubercular infection in the body, and as such it is always a source of danger to the economy, including the pulmonary system. I have frequently seen the cervical glands enlarged in early as well as advanced apical tuberculosis, this often being true first of those situated directly at the angle of the jaw.

Tubercular ulcers may precede the evident signs of thoracic phthisis, and if recognized offer a ready means of certain diagnosis of the tubercular infection. They occur often around the anal opening, and their floors usually swarm with tubercle bacilli, which can be demonstrated in the usual manner.

Finally, any preceding infectious disease, followed by a delayed recovery, a cough, a suspicious and persistent slight increase of temperature, continued failure to gain weight, should remind the physician that there is a foe always ready to attack any or

every tissue that is in a condition of impaired vitality, or whose resisting power is below par. Foremost among these diseases are pneumonia, grippe, and syphilis, both in adults and children; especially in the latter, measles, whooping cough, and the so-called tendency to tuberculosis appear to act as predisposing factors.

#### SUMMARY

By way of summarizing the symptom-complex of incipient phthisis, I would suggest the following picture.

In nearly all of the 86 cases considered in this study, in response to careful questioning by the writer, the first symptom obtained was a persistent cough, without a recognized cause. This often began with a "cold," and often then disappeared. It was sooner or later followed by the necessity of frequently clearing the throat, and later by a more or less free expectoration. In certain cases the sputum was occasionally streaked with blood; in others bloody sputum was constant; in most it was never present. A certain few cases early experienced a profuse hemorrhage. Nearly all noticed that they felt tired and were slightly short of breath on exertion. Some recognized the fact that the extremities were always cold. Some few had night-sweats very early in the course of the disease. But here the list of the early subjective symptoms finds its completion. The occurrence of any one of these symptoms is sufficient to suggest a careful and complete physical examination, and if this is conscientiously made, though it require weeks and months in its accomplishment, the patient will have reason to be grateful, and another focus for the certain spread of the disease will have been removed by prevention. The series of incipient cases yields the following suggestive figures:

#### In 15 incipient cases

Cough was the first symptom in .....	13
Night-sweats appeared in .....	6
Considerable sputum in .....	12
Tubercle bacilli present in the sputum in .....	5
No bacilli in .....	7
No sputum in .....	3
Palpitation noted in .....	12
Pain or discomfort in chest in .....	13
Loss of weight in .....	11
Hemorrhage in .....	8

Subnormal temperature constant in .....	13
Slight fever in .....	2
Family history of phthisis .....	12
Digestive tract disturbed in .....	8

#### In 71 more or less advanced cases

Cough was the first symptom in .....	64
Cough entirely disappeared and then recurred .....	8
Family history unknown .....	34
No tuberculosis in family history .....	21
The father was tuberculous .....	3
The mother was tuberculous .....	6
The grandparents were tuberculous .....	1
A brother or sister was tuberculous .....	10
A wife was tuberculous .....	1
Cases in which pneumonia antedated phthisis .....	7
Cases with gastric pain as first sign .....	1
Chills and fever the first sign .....	1
Hemorrhage the first sign .....	1
Cases with no gastric trouble at any time .....	3
Fistula in ano the first sign .....	1
Cough dated from childhood .....	5
Cases with neither cough nor sputum at any time .....	1

In concluding, I would say that there is no question in my mind that a positive diagnosis of tuberculosis should often be made long before fever is present, and long before tubercle bacilli have been found,—sometimes before sputum can be obtained for examination (*vide* Case X). A probable diagnosis of tuberculosis should be made in a case in which a long, persistent and otherwise unexplainable cough is accompanied by either a subnormal temperature, or one that rises slightly during the afternoon. When other signs appear, this tentative, care-providing diagnosis will become a positive one. It should never be allowed to *become* positive, however, and the satisfaction of the complete diagnosis should be compensated by the gratification of the cure which follows on the heels of foresight and foreknowledge.

In a recent letter from Dr. E. L. Trudeau, to whose sterling pioneer work I wish to give the credit for much of the inspiration to study along this line, there is a keen sentence. "The average medical man's idea of tuberculosis only relates to the disease after the rational and physical signs have become well marked."

At the present time this statement is unquestionably true. It should not be true, however, a day longer than is necessary for the

training of a new generation of medical men, and I was therefore sorry to hear the Health Officer of New York City make the assertion a few nights ago that the general practitioner cannot be expected to diagnose tuberculosis of the lungs in the early stages of the disease.

We should see to it that our sons do not find our eyes and ears grown too dull, and our enthusiasm too cold, to admit of a careful and brilliant examination of the patient by every known method. The result will be as certain as the study will be full of interest.

# UREMIC PSYCHOSIS; MULTIPLE GASTRIC ULCERATION; DIABETES MELLITUS

A CLINICAL LECTURE DELIVERED AT THE PHILADELPHIA GENERAL HOSPITAL

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## UREMIC PSYCHOSIS

GENTLEMEN: The first patient that I show you to-day is presented to illustrate the results of treatment in apparently desperate cases. This man was picked up on the street and brought to the hospital half unconscious and wholly hallucinatory, and was taken to the "drunk ward." As soon as he came under medical observation there, it was seen that he was not suffering from alcoholic coma but from uremic coma. He was then transferred to the medical wards—being in a very bad condition. I use the word "coma" in a general way rather than in its strict significance. When I first saw the patient he was semi-comatose; but by great effort he could be aroused to some confusional utterance, whereupon he would lapse again into a low muttering or into an apathetic silence, oblivious or even unconscious of his surroundings. Perhaps "stupor" would be a better term. His temperature on admission was  $97.5^{\circ}$  F., but it soon fell to  $97^{\circ}$ , then rose to  $99^{\circ}$ , at one time to  $101^{\circ}$ ; then fell again to  $97^{\circ}$ , and since has been oscillating between  $98^{\circ}$  and  $99^{\circ}$ . This condition continued for several days. When the patient began to regain consciousness, he was still much emaciated—the cheek was a vast hollow and the eyes were sunken, the cheek-bones and jaw-bones showing through the tense skin like a death's-head. The analysis of the urine revealed much albumin and many hyaline and granular casts. Nitroglycerin, compound jalap powder, elaterium, and magnesium sulphate (to drain off water by the bowel), were given from time to time. Adrenalin (10 minims, 0.6 c.c.), by hypodermatic injection, was given once when the pulse had become very thready and feeble. On another occasion, when the heart seemed on the verge of collapse, 20 minims (1.2 c.c.) of 10 per cent.



camphorated oil was injected hypodermatically. Hypodermoclyses were made use of during the first few days, the solution employed consisting of sodium chlorid, 60 grains (4 grams), and calcium chlorid, 1 grain (0.06 gram), to the pint (500 c.c.) of water.

After three or four days the salt solution was given by the rectum from time to time, in order to keep up the secretion of urine and maintain the bulk of the fluids of the body. Anasarca was not a feature of the case; on the contrary, there seemed to be a distinct loss of bulk of the body fluids, as shown by the harshness of the skin, the small volume of the pulse, the sinking of the eyes, the emaciation. At one time during convalescence, as I see from the record, the patient was given whiskey, at one time strychnin, and for quite a while infusion of digitalis with potassium acetate. At another time nitroglycerin was added to the digitalis. In other words, the treatment was symptomatic, but always eliminative and supportive, changing the particular agent from time to time in accordance with the particular indications. These cannot be reproduced; you have to see the patient and note all of his symptoms to understand why at one time strychnin seemed the best cardiac tonic, at another time camphor, at other times adrenalin (or suprarenalin); why at times digitalis was needed to keep up the action of the kidneys, at other times saline infusion by the skin or by the rectum. Nitroglycerin seems to have been given pretty well throughout this illness, and it is a very valuable remedy in just such conditions, even when the pulse is small and thready. We did not bleed this patient. Frequently it is necessary to bleed uremic patients, and usually in my wards, so soon as the patient is brought in with a correct diagnosis of uremia, the resident proceeds to bleed without waiting for me to see the patient, because he knows that I favor this treatment. Free venesection is followed or accompanied by venefusion; that is by saline infusion into the vein. In uremia the blood is often so thick that it will not run freely from the open vein until the saline infusion is introduced into another vein. In a case of marked uremia, this combination of measures, carried out as soon as possible, will frequently save life. When, however, the patient has been tided over the uremic attack, he has not recovered from the disease underlying the attack. I called your attention in the cases of two patients presented at our last meeting to the actuality, not merely the possibility, but the actuality of chronic uremia. One

who has a badly damaged kidney is in a constant state of uremia. We have not only to guard against the toxic explosion that comes as eclampsia or as coma, but have to deal with a constant state of toxemia, and therefore eliminative measures must be kept up throughout the life of the patient.

Now, I want to call your attention to one of the less common, but by no means rare, phenomena of uremia, as manifested by this patient after his recovery from the acute toxic explosion, and, indeed, until yesterday.

This man was, throughout his convalescence, the subject of what may be termed "consistent hallucinations."

Q. How do you feel?

A. "I feel perfectly natural."

Q. Where were you yesterday?

A. "I was exercising in the wards."

Q. You have not been taking any ten-mile walks, then?

A. "No, I had that idea when I first waked up here, but it's all gone now."

Q. Do you remember it?

A. "Oh, yes, but my delusion left me all at once, yesterday."

He has used the term "delusion." I do not use it in regard to this case, although, strictly speaking, it is correct, because he never said he was taking this ten-mile walk, but that he had taken it or had to take it; meanwhile realizing that he was in bed or in the rolling-chair and under treatment in the hospital. I call it, not technically, but as a convenient clinical term, a consistent hallucination.

We have to-day not only a physical, but a mental recovery. His mental state was dubious for so long a time that I had contemplated having the patient examined by our alienists to see whether there could be something more than uremia in the case. But his absolute recovery indicates that the mental confusion was simply due to uremia. The point is that for a long while after this man had a good physical recovery, and was sitting up around the ward, as fat and as smiling as you see him now, he had these hallucinations, or, as he terms them, "delusions;" at all events, a uremic psychosis, perhaps even a genuine confusional insanity. The condition was not what we ordinarily call delirium,—that is, a state of mental confusion, with obliviousness to surroundings and more or less

excitability,—but it was a rather organized, although fleeting delusion, or consistent hallucination, that he had to go out every day and take a ten-mile walk around town; and he would tell us the events, with the sights and scenes that he had observed in his walks.

The case suggests the close connection between toxemias and mental diseases.

I have seen transient phenomena of melancholic insanity, apparently due to intoxication, dependent upon long retention of feces—the patient having daily stools, but no “evacuation”—no complete emptying of the lower bowel. Perhaps the persistent forms of mental alienation are due to subtler and more obstinate forms of toxemia. It is well to bear this possibility in mind, and not to condemn a person to an asylum who is simply suffering from uremic poisoning. This condition is an argument in favor of the view that all forms of insanity are toxic. We are familiar with the deliriums of acute febrile diseases—evidences of intoxication. We are familiar with alcoholic psychoses of many varieties. Confusional phenomena are not rare in acute uremia. Here you have an example of quite persistent confusion in chronic uremia.

MULTIPLE GASTRIC ULCERATION

CASE II.—This patient's diagnosis is somewhat doubtful. See if the class can help me out; as the Rev. Dr. Wayland used to say, I cannot get a unanimous verdict in my own mind.

George McB \* \* \*, aged 29 years, a carpenter, on last Tuesday night had a profuse hemorrhage issuing from the mouth. The blood was “black and lumpy.”

Q. Were you ever sick before this?

A. “No, sir.”

Q. Did you cough the blood up, or spit it up without cough?

A. “I vomited.”

Q. You are sure you vomited?

A. “Yes, sir. It felt like vomit.”

Q. Did it happen suddenly?

A. “Yes.”

Q. What were you doing at the time?

A. “I drank two glasses of water and sat down on a chair and was taken sick.”

Sudden sickness at the stomach after drinking two glasses of

water, vomiting of the water, and clotted blood with it. The blood was black and lumpy, showing that it was not recent bleeding.

Q. Did you vomit blood afterward?

A. "No, sir. Just one vomit."

Q. Was there any pain?

A. "Yes, sir, as soon as I drank the water."

Q. Where did you feel the pain after you drank the water?

A. "Here." (The patient places his finger on a point midway between the xiphoid appendix and the umbilicus in the median line.)

Q. Have you any pain there now? Does it hurt when I press there?

A. "No, sir."

Q. Did that pain disappear as soon as you vomited?

A. "Yes, sir."

Q. Sit up a moment. Is there any pain along the spine as I press there?

A. "No, sir."

We do not cause nausea or vomiting or elicit any sign of tenderness by pressure on the epigastrium or on either side of the fifth vertebra or of any other. There is absolutely no pain or tenderness, abdominal or spinal.

His father and mother are both dead. The cause of the father's death is unknown; the mother died of pulmonary tuberculosis. One brother is living, one brother died of an accident. A sister is living and in good health. There is no history of malignant disease in the family. During childhood, the patient had measles and mumps. He does not recall any other of the ordinary diseases of childhood. At 26 years of age he had pneumonia. He has always used tobacco and alcohol in moderation. He denies having had venereal disease. This scar on the forehead is due to an accident in boyhood. There is no reason to suppose that he has had syphilis; the scar does not have a luetic appearance, and there is no other evidence suggestive of the disease. The record states that two or three days previous to last Tuesday—that is nine days ago—the Tuesday before his admission to the hospital, he had been feeling weak and dizzy, and felt shooting pains throughout the chest, but not in the stomach; then he drank water, experienced abdominal pain, and had the vomiting attack which gave him relief. On

admission the pulse was weak and of low tension. Both pupils reacted to light and accommodation. The pulmonic second sound was accentuated, no murmur; otherwise, the cardiac phenomena were normal; the lungs were hyperresonant; the liver dulness extended three fingers' length below the costal margin. I find the chest is now hyperresonant throughout as stated, but the liver dulness is not enlarged. However, the note is distinct that on admission it was three fingers' breadth below the costal margin. The patient is slightly emaciated, very pale. The lips are bloodless. The antero-posterior diameter of the thorax is increased.

*Q.* Are you always pretty short of breath?

*A.* "I am never short of breath."

He has, nevertheless, a somewhat emphysematous chest.

The gastric contents were examined, of course, by a test meal. Pepsin was found to be decreased 15 per cent. by estimate of albumin digested, free hydrochloric acid increased 200 per cent., total acidity decreased 29 per cent., according to the standards adopted in this hospital, by a new method with which I am not familiar. At all events, these are the comparative figures: total acidity is diminished a little less than one third, while free acid seems to be increased about 200 per cent. The blood-count gives hemoglobin 45 per cent.; red blood-cells 3,000,000, white blood-cells 6762, no nucleated red cells; no poikilocytes. The man is evidently anemic, his lips are almost white. There is no doubt that what he spat was blood.

*Q.* Did you pass blood by the bowels? Did you have any black stools at home?"

*A.* "I did not look."

He does not know whether he passed blood by the bowel or not. Since entering the ward he has neither vomited blood nor passed blood by stool.

What is the diagnosis? (Some one answers, Anemia.)

Yes, he has an anemia, the result of loss of blood, that is evident. The anemia is of profound degree, but it is not like that of the cases of pernicious anemia which I showed you some weeks ago. The color-index is  $\frac{4}{8}$ —less than unity, or, if you prefer the percentage method, 0.75, less than 1. In pernicious anemia it exceeds the normal. There is no poikilocytosis; megaloblasts not only do not preponderate, they are absent; in fact, even normoblasts are

absent. Prognostically, I should prefer to see normoblasts in moderate number. Thus, none of the distinctive characteristics of pernicious anemia is present. Then again, while the total erythrocyte count is low, it is not so low as in pernicious anemia. You remember in one of our cases it was 1,080,000, and in the other, the case improving under treatment, it was only a little more than 2,000,000. We have here a quantitative anemia from loss of blood, and also a low hemoglobin index, suggesting chlorosis, or at least chloroanemia following the hemorrhage. What was the cause of the hemorrhage? The first thing one thinks of in hemorrhage from the stomach is gastric ulcer, especially when we find hyperacidity, but in gastric ulcer we expect pain, we expect tenderness upon pressure; we do not ordinarily think of gastric ulcer manifesting suddenly with hemorrhage and giving no other symptom before or after. Duodenal ulcer might possibly cause such a hemorrhage, but we would be much more apt in that case to have melena, bloody or black stools, and again we expect pain localized somewhere. Then we think of cirrhosis of the liver. Cirrhosis of the liver very frequently causes hemorrhages from the esophagus or from the stomach by interference with venous circulation. The black blood, if fresh, would look rather like venous blood than arterial, but arterial blood may be discolored by the gastric acid, and, furthermore, this seems to have been rather the washing away of the clots than a hemorrhage at the time of the vomit. There may have been a slow oozing during the period of prodromal dizziness. However, I get no evidence of cirrhosis of the liver. If there had been acute congestion of the liver, as indicated by an increased extent of liver dullness, which has since rapidly disappeared, we might perhaps have an explanation in that the congested condition of the liver has interfered with the venous circulation and thus caused venous hemorrhage in the stomach, but that again is not by any means a dependable diagnosis. Cirrhosis of the liver may cause severe and even fatal hemorrhage from a varix of stomach or esophagus, but we do not have here a cirrhosis, unless in a very early stage, and profuse hemorrhage does not occur in the early stage of cirrhosis. Aneurism sometimes ruptures into the stomach or esophagus causing hemorrhage, but we have here no evidence of either thoracic or abdominal aneurism. I do not know—that is, I am not sure—what is the matter with this patient. Gastric ulcer is perhaps the diag-

nosis to which we can find the least number of objections, and I will put it down tentatively, by exclusion, as a case of gastric ulcer. The excess of free hydrochloric acid may be taken as confirmatory, though in itself insufficient for a diagnosis. This we do know, to be entirely fair to ourselves as well as to the patient, that gastric ulcer sometimes is latent for months or years. Whatever its duration may be, it gives no sign until suddenly there is hemorrhage, perhaps even perforation causing peritonitis, sometimes fatal unless immediate operation is undertaken. Very many cases are on record in which sudden perforation of latent gastric ulcer has occurred; some of the patients have died, others have been saved by prompt operation. On the other hand, it is quite possible that vague premonitory symptoms have gone unnoticed or have been attributed to "indigestion" and have been forgotten. I presume this to be one of those cases of comparatively latent gastric ulcer, and I shall take surgical counsel as to the advisability of operation.

The treatment has consisted in quiet, restriction of diet, feeding by the rectum for two weeks, until we were reasonably sure that there would be no more gastric bleeding, then the cautious use of pancreatized milk and junket by the mouth. We have also given salts of bismuth as sedatives and occlusives for the suspected ulcer. A very useful treatment in cases of gastric ulcer which has recently been introduced is the use of silver vitelline, a substance invented or discovered, whichever is the proper term, by Dr. Barnes of this city, and marketed under the commercial name of argyrol. It is useful as an astringent and antiseptic and alterative upon mucous membranes. Just what its action is I do not know. There have been several explanations given, none of which satisfies me. It does not act at all by absorption, but purely by local effect, and until we can get a microscope powerful enough to show the vital actions of living cells, we shall not be able to understand what the action is of these remedies which are not absorbed, and which yet have a distinct bio-chemical action of some kind, as shown by the disappearance of inflammation, the inhibition of morbid secretion, the reduction of thickened tissues, the healing of ulcerations. I have seen all these effects from argyrol solutions (10 to 50 per cent. in water) applied to the nose and throat. I have also observed good results from its use in gastric and intestinal catarrh, especially in one case of mucomembranous colitis. As it is not absorbed, it can be given

in practically unlimited doses, 12 to 15 grains, three or four times daily. In cases of gastric bleeding adrenal preparations given by the mouth are also useful—the powder dissolved freshly in water, filtered, and the clear liquid given, is better, in these instances, than the active principle. One-half teaspoonful of powder in about two teaspoonfuls of water makes a fair dose. Sometimes, when water is objectionable, the powder, rubbed very fine, can be given undissolved. Or the commercial solutions of adrenalin and suprarenalin, which are of a strength of 1:1000, can be used, the dose being 10 drops to a teaspoonful. Other styptics and hemostatics can be used, but I need not now dwell on them. Calcium chlorid and hydrastinin are among the best; cotarnin, turpentine, thymus extract, Monsel's salt, gallic acid, silver nitrate, lead acetate may be mentioned. After hemorrhage has been controlled, careful regulation of the diet and the long-continued use of alkaline salts, as sodium phosphate and sodium sulphate, should be instituted. This is necessary even after surgical operation as a measure of prevention against recurrence. Multiple recurrence<sup>1</sup> is perhaps more common than we realize as yet.

DIABETES MELLITUS. EXPERIMENTAL USE OF GLYCOGEN

CASE III.—Q. How long have you been sick?

A. "About 4 months."

Q. Don't tell me the name of your disease. What was the first thing that bothered you?

A. "I felt itchy all over."

Q. What was the next thing you noticed?

A. "I felt bad all over—weak."

Q. What next?

A. "I noticed I was passing a lot of water—a bucketful a day or more."

Q. When did that start? Before you began to feel bad all over?

A. "About the same time."

Q. About the time you were feeling bad all over, you began to pass a bucketful of water a day. Were you thirsty?

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<sup>1</sup> Further hemorrhage occurred and surgical interference was deemed unwise in the patient's weak condition. Autopsy showed many old, healed ulcers, and two large recent ones. The case will be reported to the Philadelphia Pathological Society.



A. "I was ready to drink any time of day."

Q. What?

A. "Water or anything."

Q. Did you ever drink anything else but water?

A. "Not here. Outside I drank liquor and beer."

Q. By liquor, do you mean whiskey?

A. "Yes, I never was no friend to gin."

Q. How old are you?

A. "Forty-three years."

Q. What was your work?

A. "Peddler. Fruit peddler."

That is, he was a huckster, much out of doors, exposed to all kinds of winds and weather, and not abstemious in his habits. He was admitted to the surgical ward about 2 months ago, and transferred thence to the medical ward.

Q. Why were you admitted to the surgical ward?

A. "I had a lump on my jaw."

It has disappeared, and I find no note of its nature. The record states that he has had the usual diseases of childhood. He had edema of the lower extremities 3 years ago. He has been a hard drinker for the last 15 years, mostly of whiskey. The notes state that his first trouble was itching all over the body.

Q. When did that itching begin?

A. "About 4 months ago."

But the history states that he began to pass an excessive quantity of water about 3 years ago, not 4 months ago; during the last 4 months, he now explains, the condition has become much worse.

The itching is a very distinctive symptom. It is often the earliest to attract the patient's attention in the condition, the existence of which, in this case, the class has already recognized.

This man has had great loss of flesh and strength. At night he is troubled with disturbance of vision, different colors pass before his eyes. The pupils react normally; the eye-grounds have not yet been examined. The heart and lungs show nothing of special moment. The knee-jerks are gone. The quantity of urine passed varies—we have records of 160, 179, 180, 165, 180, 172 ounces a day. It varies, then, from 160 to 180 ounces in the 24 hours. Of course the class knows what we found on examining it. What was it? I am correctly answered—sugar. We also find albumin,

but rarely; only occasionally is there the note made "albumin a trace." The sugar varies from 2 to 4 per cent.; that is to say, from about 10 to about 20 grains to the ounce in urine which varies from 160 to 180 ounces in the day. The highest record here is 4 per cent., the least record 2 per cent. of sugar. It is a case of diabetes mellitus.

*Q.* Are you ever hungry?

*A.* "I have been very hungry; couldn't get satisfied."

The cardinal symptoms by which we distinguish diabetes mellitus from glycosuria are, in order, the polyuria, the thirst, the bulimia or excessive appetite, and the progressive emaciation. Polyuria, thirst, excessive appetite, emaciation distinguish the syndrome diabetes mellitus from the symptom glycosuria. Glycosuria and polyuria would not constitute a fully developed syndrome, there must be also the thirst, the emaciation, and the excessive appetite. The itching and the appearance of boils are commonly early symptoms. If a patient presents persistent or recurrent furunculosis, we should suspect diabetes and watch the urine carefully for its development. Of course it is not the only cause of boils, but it is to be remembered and looked for. I say the "syndrome" diabetes mellitus, and not the disease. I do not know any definite disease called diabetes mellitus. I have frequently called your attention to the fact that we are much in the habit of giving names to a collection of symptoms that we do not understand, and fondly imagining that we have thus explained them. Especially if it be a Greek name, it is very comforting. Glycosuria is now well recognized to be only the name of a symptom—sugar in the urine is only a symptom. I think we can safely go further and say of this whole syndrome group that diabetes mellitus is merely the name of a group of symptoms, and not the name of a disease. Diabetes mellitus, as described in text-books, is of several varieties. We have gouty diabetes and diabetes in the obese and in the old, and these are generally of favorable prognosis. We have diabetes resulting from disease of the liver, which may be of favorable or unfavorable prognosis; we have diabetes resulting from disease of the brain, and then usually of grave prognosis, especially in the young; diabetes resulting from general disease of the nervous system, diabetes associated with disease of the thyroid gland, diabetes associated with disease of the pancreas, with various pancreatic lesions, as sclerosis,

occlusion of the duct of Wirsung, calculi in the pancreatic duct, destruction of the islands of Langerhans—we have too many varieties, we have too much pathology, and with it all we have nothing definite. This whole group is not one disease dependent upon various pathologic lesions, but it is a syndrome group which occurs in various diseases of diverse etiology and pathology, although as yet we lack the means of differentiating these various diseases from one another with certainty. We ought to know when a patient complains of this syndrome group whether or not it is dependent upon toxemia or upon lesions of the liver or lesions of the nervous system, or lesions of the pancreas, or gout, or obesity, or other functional metabolic failure. I know no means of estimating these facts, excepting an empirical one, which is very much like that of the nurse in the old tale, which you have probably heard, who needed no thermometer when giving the baby a bath—because when the water was too hot the baby turned red, and when the water was too cold the baby turned blue. When we have a young and emaciated patient we say the prognosis is bad, and that the diabetes is probably pancreatic in origin. When we have an obese patient in late middle life we say that the prognosis is good, and the diabetes is probably hepatic in origin. That is pure guess-work, and is no more scientific than the rule of thermometry by the baby's color. The discovery of persistently excessive uric acid or urates in the urine, or the presence of other gouty symptoms or gouty heredity perhaps justifies a diagnosis of gouty glycosuria, but I have frequently seen the entire syndrome including boils and pruritis in young persons as well as old persons of gouty history and lithemic type, and have noted both recovery and death in such patients.

The question of treatment thus remains an empirical question, because we are in doubt as to the pathology and know nothing whatever as to the etiology; we are still bound up to a very unsatisfactory clinical diagnosis. We cannot make a pathologic diagnosis, and we cannot make an etiologic diagnosis. Therefore, the therapeutic diagnosis, instead of having three legs to stand on, has only one, and a three-legged stool with two legs missing does not furnish a very secure seat.

However, there are several agents that empirically have been found to do good in the various classes of cases of diabetes mellitus. When the gouty diathesis is present, anti-gouty treatment

is useful. Of the drugs that I have found of service in such cases, strontium bromid stands in the front rank. In ordering strontium bromid I usually specify the imported French preparation, as some of the domestic preparations are contaminated with barium, which irritates the stomach and causes the patient to vomit, producing as well other effects, which, whether physiologic or toxic, are not desired and are therefore harmful.

The question of diet I can dismiss in a few words: use a restricted diet, avoid a rigid one. The total exclusion of starches and sugars is impossible and unnecessary, but the quantity of carbohydrate foods should be diminished and kept down to the lowest point compatible with the patient's comfort. That may be very little in one case, and may mean quite a liberal diet in another case. We must individualize strictly. This means rational experimentation, weighing the patient from time to time, and also taking into consideration his general comfort, which is a much more important sign than the number of grains of sugar found in the urine. Milk, which some authors tell us should be avoided because it contains milk-sugar, is the most valuable single article of diet we have for the treatment of diabetic patients. Milk-sugar, as a rule, is utilized, transformed, burnt up by diabetics. I have made several experiments to test this, administering pure lactose to patients whose urine had become free from sugar, and to patients passing a fairly constant quantity of sugar. Very little or none was recovered from the urine; some patients, however, do not take it very well: it increases the output of urinary sugar—glucose. Perhaps these are instances of different diseases tagged with the same name. We can only discriminate therapeutically as we watch the patients. In most cases, fruit-sugar, or levulose, is well borne. That can be given in large doses and helps to make up the necessary carbohydrate aliment. We should diminish glucose and maltose and substitute lactose or levulose. Also we can give hydrocarbons in place of starches and sugars. Patients need carbon and hydrogen in some non-proteid combination to retain their animal heat and to carry on various chemico-biologic processes which we do not, as yet, understand. The old, crude idea that food-stuffs are burnt in the animal system like coal in a furnace—only by slow instead of rapid combustion—is doubtless incorrect. There is some mediatory process—catalytic, enzymic, what you will—but there is a profound physiologic truth beneath the crude form of

statement. We must furnish sufficient non-proteid carbon and hydrogen. Oils and fats may be given freely, and of fats, butter is about the best. Bread gives most difficulty. Patients need bread; they are not satisfied with any of the substitutes. I have tried them all,—almond bread, egg cakes, soda flower, and so-called gluten flour, which usually contains much more starch than ordinary flour,—but none is worth wasting time or money on. Most of the commercial gluten flours are said by their manufacturers to contain no starch or very little starch, which is not true. There is one gluten flour which is not a humbug. I say this to avoid libel suits. I cannot say which one it is. The best plan is to allow the patient a limited amount of bread made from ordinary flour, or, if he prefer it, let him have two ordinary slices of toast with each meal. That will satisfy him and will not do any harm. If he does well, the quantity can be increased and ordinary untoasted bread given occasionally in addition. If the patient prefers biscuit, we can allow him a limited quantity of biscuit. We need not bother about almond or gluten biscuit, just plain every-day biscuit that we can buy at any grocer's. Meat and fish may be given, observing the ordinary rules in regard to cooking, avoiding frying and avoiding veal and pork. Fowl is permissible. The green vegetables may be given freely, but the starchy vegetables—that is, the roots and tubers—kept down to the minimum; beets, which contain much sugar, must be excluded. I usually exclude potatoes also, but every once in a while a patient gets a longing for a potato, and then I let him have one well-baked (roasted). That may be given, say, once a week, more or less, if needed, to satisfy the desires of the patient.

To leave the subject of diet, and speak again of drugs, in addition to strontium bromid, codein is the one used empirically with most success in the largest number of cases of diabetes mellitus, taken at random. If codein is used, it should be pushed;  $\frac{1}{8}$  grain may be given 3 times a day for a week, the dose increased by an addition of  $\frac{1}{8}$  grain for another week, and so on, increasing later, if necessary, by quarter-grains and half-grains, until the patient may finally be taking from 12 to 20 grains of codein daily. The effect on the excretion of urine and sugar is the guide to the dose. Usually 3 grains thrice daily will suffice. If it is well borne and there is progressive diminution of urine and sugar, it is doing good. After getting the maximum effect possible from codein, it is to be diminished to the

minimum that will hold the effect. In other words, we must use good judgment, increasing or diminishing the drug as needed, or stopping it altogether if it is not useful. Another drug that may be tried is uranium nitrate, used in the same way as codein, beginning with  $\frac{1}{8}$  of a grain 3 times a day for a week, and then pushing to the point of tolerance, which may be 5 or 6 grains at a dose 3 or 4 times a day, watching the effect and seeing whether it produces not only diminution of sugar but also improvement in the general condition. In order to determine whether any drug is doing good, it should be used for at least 3 or 4 weeks; a single week is useless, because there are spontaneous variations in the amount of sugar passed by a patient from day to day. The recent discoveries concerning uranium, its radio-activity, its association with radium, and the fact that its action is uncertain, invite speculation as to the cause and nature of the effect attributed to uranium, but to this I can only allude.

Very recently two other medicaments have been advocated in certain cases of diabetes mellitus; one of these medicaments is glycogen, a substance that one would not be apt to think of, seeing that glycosuria results from some failure of the metabolic processes concerned in the production or utilization of glycogen in the organism. However, Dr. Pettit, of Paris, has introduced glycogen as a useful agent in the treatment of diabetes mellitus, and reports excellent results from the administration of 1 or 2 grains 3 or 4 times a day. He gives it one hour before meals, so that the process of digestion shall not interfere with its absorption and action. He thinks that it acts dynamically to restore normal metabolism. If one gives a push to a brick at one end of a row, that impulse is transmitted from brick to brick until it throws down the last one. In some such way, by biochemic impulses transmitted from cell to cell, glycogen therapeutically administered is supposed to influence the metabolic processes. Whether that is so or not, the empirical observation is worth making a note of, and having some glycogen sent to me for experimentation, I have ordered it for this patient. It is impossible to regulate his diet; not that the hospital authorities are unwilling, but the patient is disobedient. He begs the forbidden articles of food from other patients, and, as he is not confined to bed and cannot be deprived of air and exercise without harm, he cannot be restrained. So there has actually been very little dietetic

restriction in this case. If we find that glycogen diminishes his glycosuria, I will be sure that it is a useful agent for empirical administration in diabetes mellitus.<sup>2</sup>

The other drug that has lately been again urged, and most emphatically by French observers, is brewers' yeast. Brewers' yeast has been used by the laity for many years. It was at one time a common domestic remedy for boils, indigestion, anemia, consumption, St. Vitus's dance, and other ailments. Lately it has been introduced into scientific therapeutics. In the form of "cerevisine" it is a desiccated pure culture of *Saccharomyces cerevisiæ*, convenient for internal use, but it can be used in any other convenient form in which yeast can be obtained. It is given in such doses as the patient can bear, 3 or 4 times a day, and is said to be very useful. I have no experience with it, but the reports of the French observers are encouraging, and I purpose to try it in the next case which offers a suitable field for experimentation in this line.

Oxygen inhalations and the internal use of hydrogen dioxid seem to do good in some cases. Thymus extract, thyroid extract, adrenal extract, have all been credited with curative virtue in diabetes. On the other hand, adrenal preparations and thyroid preparations, in certain experimental observations, have produced glycosuria. Pancreatic preparations of various kinds have been used with asserted success, but I have not been able to get good results even from hypodermatic use in cases that seemed to be of pancreatic origin. On the other hand, I found that the digestion of tissues I feared from injection of pancreatic solution did not occur. When all is said, we have no specific. The individual case and its individual needs must be studied. General hygiene, especially baths and exercise, must be prescribed carefully. Sometimes various hydrotherapeutic applications, chiefly such as stimulate metabolism, are useful adjuncts in treatment. I have seen beneficial results from the glycerophosphates in neurotic and anemic subjects with the diabetic syndrome. Arsenic (especially arsenic iodid and arsenic bromid) and the double salt known as gold-and-sodium-chlorid are likewise useful at times. But we wait for means to make the pathologic and etiologic diagnosis before we can give scientific data for drug treatment.

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<sup>2</sup> Glycogen given for four weeks was devoid of influence in this case. Urinary and other phenomena were practically unaltered.

## ON GALLOPING TYPHOID FEVER

BY H. ROGER, M.D.

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FIVE years ago I had a patient in my wards at Aubervilliers the interpretation of whose symptoms seemed unusually difficult.

A young woman of 18 years had been suddenly seized, February 21, 1900, with malaise, headache, and fever. The following day she was transported to the hospital, where, when we came to examine her, we found her in such a state of deep prostration, that, although the beginning of her infection only dated from the previous day, we might have thought ourselves in the presence of a case of typhoid fever that had reached the second week of its course; headache was acute, there was painful meteorism of the abdomen, and the spleen was enlarged. The clinical tableau was completed by diarrhea, bronchitis, and an eruption of lenticular spots, whose precocious appearance and abundance were quite disconcerting. They were small papulæ that disappeared under pressure and were spread over the abdomen, trunk, limbs, and even the face.

During the following days the eruption increased, while the urine became albuminous. On March 2, ecchymoses appeared about the malleoli, and on the 4th some were visible on the legs and abdomen as well. At this period the pulse was 140; the temperature, which had steadily oscillated about 104° F., rose to 106° F., and in the evening to 108° F. and over. The patient, whose condition had grown steadily worse, sank into a coma and eventually succumbed.

What could this curious infectious process be which had suddenly stricken this young woman down in perfect health, and in less than 12 days had brought her to the grave? As no post-mortem was allowed, the diagnosis remained uncertain between a form of typhoid fever with an extraordinary rapid evolution and a case of sporadic typhus. The suddenness of onset, the precociousness and extent of the eruption, and the number of ecchymoses, led us to favor the latter hypothesis, toward which we were also



guided by the hematologic examination, which had been performed on February 28, when the blood serum had failed to agglutinate Eberth's bacillus.

This case would have remained without precise significance if chance had not thrown in my way quite recently another case almost exactly similar to the first one.

A young woman of 23 years entered the wards at Aubervilliers November 3, 1903, accompanying her child, who was suffering from suppurative otitis. She was in good health, and remained in the ward without a sign of any disorder. But on December 4, toward the latter part of the day, she complained of intense headache, and felt some rigors, which were soon followed by epistaxis. Her temperature was then taken and found to be 106° F. The next day the patient was prostrated; headache continued, severe, very distressing; and the tongue was dry, white, and clean along the edges. Examinations of the different organs gave no information. Auscultation of the lungs revealed fairly numerous rhonchi, large and small, particularly abundant at the bases. Next day, December 6, the condition of affairs was the same. The patient was constipated. The abdomen was not distended, and was not painful. Over the lower portion of the thorax and on the abdomen was visible an eruption of spots similar in dimension and color to the rose-spots of typhoid fever, but simply maculous.

The situation, serious from the start, grew steadily worse. The patient became delirious, and could hardly reply to the questions that were asked her. Muscular relaxation was complete; the knee-jerk had disappeared. There was incontinence, both of bladder and rectum. The eruption became more extensive, and on December 8 it was manifestly papulous; it then occupied the anterior and posterior part of the thorax, the abdomen, and lower limbs.

The symptoms remained at this point, without noticeable alteration. The cold baths, which had been commenced on the third day of the disease, seemed to produce some slight remission. This improvement, however, was of short duration, and the conditions then went from bad to worse. The tongue became dry and wasted; the abdomen was distended and painful; the urine was albuminous. The pulse, quick and weak, was at 140, although auscultation of the heart revealed nothing special.

On December 10 auscultation of the lungs revealed a small spot

of broncho-pneumonia at the right base, characterized by a zone of dulness and blowing sounds. The pulse remained quick, but had become irregular and unequal. An eschar on the sacrum was developing.

On December 11 prostration was complete, and death occurred at eight o'clock in the evening.

When these two cases are compared, the analogy between them is perfect. In both the onset was sudden and the evolution rapid; the appearance of the rose-spots was precocious and their distribution quite abnormal; in both cases the general condition of the patient was extremely serious from the start; the high temperature, clouded intelligence, delirium, and prostration completed the symptomatic whole.

The postmortem of our second patient, by showing us the lesions characteristic of typhoid fever, enabled us to settle the diagnostic problem that had been raised by these two cases.

The mesenteric nodes were swollen, the one occupying the ileocecal angle being particularly voluminous. On opening the intestine the Peyer's patches and solitary follicles of the lower end of the ileum and of the cecum were found to be deeply affected. The condition was not one of infiltration of the lymphoid organs, such as is customarily seen at the end of the first week. Ulceration had already taken place and had cleaned itself up; the eschars had gone, leaving numerous depressions, deep, as though punched out, and surrounded by swollen mucous membrane. In the cecum the ulcerations were confluent; there were hardly more than a few pieces of mucous membrane left intact here and there between them. At some points strips of dead mucous membrane remained attached by one end. In short, the case presented the classical appearance that is described when an intense or extensive infection has reached the third week of its evolution.

The different organs showed nothing particular. The spleen was large and soft, and the liver mottled with white spots; there was congestion of the lungs, and the base of the right lung was consolidated. The heart appeared to be normal.

The results furnished by this necropsy seemed to suffice in characterizing the nature of the morbid process; but in spite of this we endeavored to base the diagnosis also on some bacteriologic researches.

On December 7 we had extracted a small quantity of blood from a vein at the elbow, and a portion of this liquid was used to determine the agglutinating power of the serum, but with a negative result. Placed in contact for an hour and a half with a recent culture of typhoid bacilli, this serum, diluted only 1 to 15, had no effect; the bacilli remained free, mobile, and dispersed.

At the same time we had carried out another experiment. Five cubic centimeters of blood had been put into three receptacles each containing 300 c.c. of peptonized bouillon; one of these remained sterile; the other two became filled in 24 hours' time with bacilli whose appearance, reaction, and ulterior development in media ad hoc, seemed characteristic. In order to ascertain beyond question the nature of these bacilli we brought them in contact with a small amount of serum taken from a patient convalescing from typhoid fever: diluted 1 to 50 the serum agglutinated the bacilli in less than half an hour. Taking, then, once more the serum of our patient, we brought it to bear on the bacillus that we had derived from her blood. This time the reaction was positive. This serum, incapable of agglutinating the elements of a recent culture, clearly agglutinated this new sample.

On going through the numerous works published on typhoid fever, a certain number of cases can be found similar to ours. But the greater number of those found go back to a time that is now remote, and some of them cannot be accepted without reserve.

In all the cases of rapid evolution the onset was sudden, as in our two patients. The long period of invasion was lacking. The infection manifested itself without any warning, sometimes accompanied by a rigor or convulsive seizure.

The disorder assumed a serious aspect from the start, and the nervous system was gravely affected; prostration was extreme, and was attended by delirium, loss of consciousness, and by urine and fecal incontinence. The intestinal disturbance varied, but albuminuria was the rule.

The early appearance and rapid extension of the rose-spots gave a somewhat special character to the evolution of the two cases above reported. All writers agree in saying that the typhoid eruption becomes visible at the end of the first week; this rule is, however, not absolute, the rose-spots appearing in some instances on the fourth or fifth day. Curschmann claims to have seen them as

early as the third or second day; but in no case, to our knowledge, have they been reported so soon as twenty-four hours after the beginning of the infectious process.

The typhoid eruption, though generally a discrete one and limited to a few papulæ, can be very profuse, far more so even than in our two cases. Thus hundreds, and even a thousand rose-spots have been counted (Murchison), so that in presence of such an abundance the clinician has hesitated and raised the question of measles or variola (Hérard, Villamin, Laveran). But even when such an eruption spreads it respects the face, which, according to Bäumlér, is only affected once in 73 cases.

Instead of pursuing a slow evolution through a cycle lasting three or four weeks, typhoid fever may assume a rapid course. The accidents follow each other in quick succession, and death occurs in less than a week. This fulminating form of the disease deserves to be well known, but many of the cases that have been included in this group cannot be accepted with perfect confidence; it is difficult, in dealing with a disease that has an insidious onset, to estimate exactly the date of its beginning. This remark is applicable to a case, otherwise of great interest, published by Guyot. A youth of 13, who had suffered for a few days from malaise and diarrhea, was suddenly seized, in the midst of his work, with an epileptiform attack. On entering the hospital he was taken with a second one. The following morning the patient was comatose, with dilated pupils, contracted arms, stiffened neck, and jaws tightly closed. Death occurred forty-eight hours after the first manifestation of eclampsia. Postmortem showed nothing more than slight meningeal congestion, and swelling of the Peyer's patches of the ileocecal region. Guyot thought that the condition of the intestine warranted his estimating the duration of the process at four days. However rapid the course of this case may have been, it is allowable to question this evolution.

On going through the statistics of the cities of Leipzig and Hamburg, Curschmann concludes that among 100 fatal cases there are from 2.5 to 3 that end between the sixth and the tenth day. He cites a most striking example of this kind of evolution, in which the temperature rose suddenly to 104° F. and death occurred at the end of the first week.

Many analogous cases can be found in the medical literature;

there are even some in which the evolution was more rapid still. Thus it did not exceed five or six days with certain patients whose histories were published by Bretonneau, Forget, Jenner, Bristowe, and Hoffmann. Who has not read in Trousseau's clinics the relation of the young woman who had taken part in perfect health in the public rejoicings on the occasion of the Emperor's marriage? The following morning she was seized with headache and fever, and she died in less than four days. Postmortem revealed in the intestine a confluent typhoid eruption.

In Murchison's case the evolution was quicker yet. A girl of nine, whose father was ill with typhoid, was suddenly seized with vomiting and diarrhea, fever, and violent cephalalgia. In forty-seven hours she was dead, and the necropsy disclosed a hypertrophic condition of the mesenteric nodes, and infiltration of Peyer's patches and the solitary follicles. This case seems demonstrative, though we cannot say the same for the celebrated epidemic in Clapham. The infectious disorder that affected the pupils in a school began suddenly forty-eight hours after the cleansing of a sewer. Out of 22 pupils, 20 fell ill, almost simultaneously, the prominent symptoms being fever, vomiting, and diarrhea, two patients succumbing 23 and 25 hours from the beginning of their illness. Postmortem examination showed swollen Peyer's patches, which had the appearance of condylomatous lumps, and which were, in one instance, slightly ulcerated. It is clear that the short duration of the incubation stage, the simultaneous appearance of the attacks in twenty patients, and the rapid evolution of the disorder give one the impression of some poisonous gastro-intestinal affection rather than that of typhoid fever.

It is none the less a fact that typhoid fever can carry a patient off in less than a week's time. In these rapid, or fulminating, cases postmortem showings vary considerably and warrant our dividing them into two distinct groups.

As a rule we find simple infiltration of Peyer's patches; the intestinal lesions have followed the classical evolution, and are neither deeper nor more extensive than they are habitually. Death is to be attributed to general intoxication, the system not having been able to resist the effect of the typhoid poison. Such were the cases, already cited, of Trousseau, Murchison, Guyot, and Curschmann; to them can be added those of Louis and of Chomel, which

showed us the exact state of the intestine at the end of the first eight days of the disease.

Our second group comprises cases of a very different order. Here the morbid process is no longer characterized by intoxication, but by rapidity of evolution. The symptoms of typhoid are all present, but follow each other in quick succession. The process, that usually takes a week, is completed in this instance in forty-eight hours. The eruption is precocious, and can appear, as shown by our cases, as early as the third or even second day of the disease, the day following the first appearance of symptoms. This galloping progression of the symptoms is connected with a galloping course in the local process. We find at the necropsy deep ulcerations, already cleaned out on the eighth day. This is not an exceptional occurrence; several writers have reported ulceration at the end of the first week (Louis, Hoeffel, Forget), and some have seen intestinal perforation occur on the ninth day (Murchison), or on the eighth (Peacock).

One of the most interesting cases from this point of view is that of Boudet, which seems quite comparable to our second case, with the sole difference that the typhoid eruption was lacking. A man, of 30 years, was suddenly seized at nine in the evening with rigors and prostration. The general symptoms at once reached great intensity, and death, preceded by a few convulsive attacks, occurred on the sixth day, exactly one hundred and twenty-nine hours after the commencement of the disease. At the necropsy the Peyer patches were found infiltrated, and ulcerated here and there, as they usually are in the third week.

Although the distinction may seem a little subtle, and although at the present time the clinical diagnosis may not appear easy to make, we think that two types of typhoid fever with rapid evolution are to be distinguished: at one time intoxication predominates, rapid and profound; at another, the morbid process is hurried, symptoms and lesions affect a galloping course.

In order to explain the difference between these two types an hypothesis may be advanced based on the more recent acquisitions of bacteriology.

The poisons produced by the typhoid bacilli are of two kinds: one that spreads throughout the entire system and produces reactions of a general nature; the other, connected with the pathogenic

agent itself, has a destructive action at the point where the microbe develops. When the diffusible secretions are the most important feature, the patient will succumb from intoxication while the local process follows its normal evolution. When the destructive toxins are particularly active or abundant, the symptoms both local and general follow each other in quick succession, and the case of typhoid, hurrying over its stages, deserves the qualification of galloping.

We are so accustomed to see typhoid fever follow a slow and cyclic evolution that we are somewhat bewildered on finding ourselves in face of a violently acute process; when all idea of an epidemic is lacking, our hesitation becomes greater still. In order to solve the clinical problem we can turn to the more recent methods of investigation; but the evolution of the disorder is so rapid that the agglutinating reaction has not sufficient time to take place,—at any rate, it was lacking in our two cases. Cultures from the blood, according to the method recommended by J. Courmont, gave us good results; they enabled us with our second patient to settle beyond question the nature of the morbid process from which she was suffering.

## PLAGUE

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Less than two decades ago the average practitioner in Britain or America regarded the subject of plague as historically interesting rather than clinically important. Since 1894, however, when it appeared in Hong-Kong, it has been carried from country to country in both Eastern and Western Hemispheres till almost every quarter of the globe has had a share, small or great, in this most fatal of all known epidemics.

It appears, as far as one can judge from descriptions found, to be identical with the disease often met with in history. The account of the epidemic which occurred among the Philistines as recorded in 1 Samuel v (Revised Version) presents many interesting and close resemblances to what is known to-day. It was evidently a bubonic variety, as the swellings or tumors were copied in the golden offerings made, as were also the mice, which seem therefore assigned as partial cause as one would gather from the words "your mice that mar the land." It is interesting also to note that it was not confined to one class, but affected poor and wealthy alike, "for one plague was on you all, and on your lords." Moreover, though the ark was sent to Beth-shemesh without any one apparently accompanying it over the border, yet it seemed to carry infection, if we may so regard the pestilence which attacked the inhabitants of that place.

Gibbon writes about an outbreak in the times of Justinian (A.D. 542), and says "the fever was often accompanied by lethargy and delirium: the bodies of the sick were covered with black pustules or carbuncles." Herodotus (*circa* B.C. 450) mentions a disease which seems to be plague, and connects it with a pest of rats occurring at the time. In Europe during the fourteenth century and again in the seventeenth century the "black death" killed vast numbers. In the earlier epidemic one-fourth of the population is said



to have perished; while in London alone during the great plague year of 1865 probably the deaths numbered 100,000. Defoe's well-known rhyme runs:

"A dreadful Plague in London was  
In the year sixty-five,  
Which swept an hundred thousand souls  
Away: yet I alive."

These numbers have only been equalled by the fearful mortality of the Indian epidemics of recent years.

At the close of 1899 it reached the quarantine station of New York, and in the following year Glasgow was visited, but owing to the prompt recognition by Dr. Colvin and others, and the energetic measures of the City Health Department under Dr. A. K. Chalmers, it was speedily stamped out.

#### CAUSATION

The etiology of plague rested on no solid foundation until 1894, when Kitasato isolated a bacillus which was found in almost pure culture in the glandular swellings and tissue fluids as well as in the blood. It was always present, and when animals were inoculated with it, the symptoms of plague were produced and the same organism was recovered from their lesions.

Often the disease acquires a hold upon a locality very gradually and is likely to be overlooked or unrecognized for some time, especially if the early cases are either of the mild or ambulant form, or of the pneumonic variety, in which case the causative organism may be long unsuspected.

This was so in Bombay until Major Childe, I.M.S., demonstrated that the severe pneumonias occurring with such frequency were really due to the plague bacillus which was found in the sputum in practically a pure culture, and was, as it subsequently proved, the most fatal as well as most infectious variety of the disease.

The bacteriologic examination is therefore one of much importance when the possibility of plague presents itself. Happily it is not difficult for the ordinary practitioner, with a little care, to identify the bacillus.

As to how it is spread there is still great obscurity. Rats, as has been mentioned, are very frequently found associated with the

advent of plague. Often the first danger signal has been the finding of numerous dead rats in the houses and streets, which upon examination are found to have died from plague. The fleas which infest a sick rat have been proved to contain the bacillus, and it has been advanced that, as the flea leaves the rat when it dies, it is not unnatural to suppose that it bites some other animal—for instance, man—and conveys thus the infection. Simond's experiments with rats in separate cages near each other seemed to demonstrate that those which had fleas upon them were a source of infection, while the rats suffering from plague but without fleas were harmless.

The fact also that the vast majority of cases show buboes in the *groin*, seems also to support the theory, as it would manifestly be easiest for fleas to bite the lower limbs, which in Indian natives, for example, are always uncovered, than any other part.

As I have had the somewhat unusual experience of being attacked myself with plague and after a long illness recovering, I may perhaps be pardoned in adding a personal remark on this question. It has been said that if it was mainly carried by fleas Europeans who catch it would not get inguinal buboes. This is not necessarily so in a hot country. In my own case I had been going about among plague patients without harm, until the warmth of the weather made it seem advisable to wear thinner clothing, in particular thin socks and thin white drill trousers unlined. Soon after this change I had occasion to spend some time in a bungalow which had been closed on account of dead rats found therein. Within a few days I was attacked.

However, one must confess the matter is by no means clear. Simond's experiments have been repeated with contradictory results. Moreover, it is affirmed that the rat flea will not bite man, and this is true of some varieties, though of others the verdict at present must be "non-proven." Certainly if infection be borne by fleas or other vermin, it is surprising that doctors and nurses do not contract the disease oftener, seeing how frequently the patients visited or brought in for treatment are in the filthiest condition.

#### PATHS OF INVASION

The usual paths by which the bacillus reaches man seems to be by the skin, through some abrasion, or bite of an insect, and through

the mucous membrane of the nose and throat. The conjunctiva is also easily, but less frequently, affected. In 1897 a nurse in Bombay received some sputum in her eyes from a patient coughing violently while suffering from pneumonic plague and herself fell ill and died.

#### CLINICAL COURSE AND SYMPTOMATOLOGY

(1) By far the most common form of plague is the *glandular* or *bubonic*, by which is meant that the outstanding early symptom is swelling of some glands, forming a mass commonly called a bubo. In the Indian epidemics of recent years, three-fourths of the cases have been bubonic.

(2) *Pneumonic plague*, in which pneumonia is prominent and severe, is the most fatal variety, having often a mortality of 95 per cent.

(3) *Septicemic plague* may occur primarily or as a sequel to some other form and rapidly proves fatal.

(4) *Ambulatory plague* and (5) *Pestis minor* are generally regarded as mild forms of the disease, though it is not altogether clear that the latter has any real relation to *true* plague caused by the specific organism. The danger of these mild cases is that while going about and their true nature being unsuspected, they may serve to spread the disease, as both urine and feces have been found to be infective.

These divisions into varieties are of course partly artificial. For instance, a case beginning as of the bubonic type may through organisms escaping into the blood stream rapidly become septicemic; and in septicemic cases there are glands such as retroperitoneal, etc., found post-mortem to be enlarged. In all pneumonic cases also the glands surrounding the bronchi are found inflamed and swollen.

Taking the bubonic variety as the most frequent type, the illness usually begins by two or three days of more or less marked prodromes, such as a feeling of lassitude, slight chilliness, and more or less headache; in fact, what might usher in any infectious disease. In very severe cases these may be absent and the onset extremely sudden. I am inclined to think, however, from the reports of those who have had suspects several days under their charge, some of whom have developed plague, that slight initial symptoms are the rule rather than the exception.

After 2 to 5 days' incubation, fever of about  $103^{\circ}$  to  $104^{\circ}$  F. sets in, and with the advent of the fever one or more glandular swellings are found, which are painful and speedily become exquisitely tender to the touch. The most frequent seat of the swellings, as has been noted, is the inguinal glands; next in order are the axillary and cervical. Defoe graphically describes them in his account of the London plague, "the swellings which were generally in the neck or groin when they grew hard and would not break grew so painful that it was equal to the most exquisite torture" and the sufferers "vented their pain by incessant roaring."

The swelling may be only the size of a bean, but usually several glands are simultaneously affected and the surrounding tissue becomes infiltrated with the effusion till a matted mass, bun-shaped, is formed. In the case of axillary or cervical swelling, the enlargement may be very extensive and cause dangerous asphyxia by pressure on the larynx.

The masses in the groin may by the periglandular inflammation attain the size of a cricket-ball or fist. The edema soon prevents one from feeling the gland itself, excepting by very deep pressure, which is greatly resented by the patient even when comatose. This edema may extend over both thighs, or in the case of axillary or cervical buboes across the whole anterior thoracic wall.

At the commencement of the disease the pulse is soft and full. It quickly becomes rapid and dicrotic, but remains soft throughout the illness. Indeed, the rapidity often serves as a most valuable diagnostic feature to distinguish it from some other acute diseases. The right side of the heart is dilated, and often there is a systolic murmur at the apex.

Respiration, even when the lungs are not directly attacked, is quicker than one would expect from the amount of fever. There is often some cough.

The tongue at first is covered with chalky-looking fur with red tip and edges; the fur after a day or two of the fever becomes first yellow and then of a dirty mahogany-brown color and shows indentation at the edges.

The breath is often foul. Either constipation or diarrhea may be present. It is often remarked that the appetite is retained to a remarkable degree. Nausea and vomiting are almost always pronounced and are very distressing symptoms to the patient,

as the emesis does not seem to diminish the feelings of nausea to any appreciable extent. The dull headache which the patient may have been experiencing for a day or two before the illness was diagnosed now gives place to an agonizing cephalalgia, which, with the pain of the buboes, remains so long as there is fever.

The decubitus is dorsal from the extreme weakness, and if there be inguinal swelling the lower limbs are flexed. There is often a good deal of aching in the lumbar region and not infrequently cramps in the calves of the leg resembling much the condition found during cholera.

The face is at first flushed and then later becomes pale. The conjunctivæ are injected. Expression is usually either fierce and angry or extremely worried and anxious looking. As the illness progresses the central nervous system becomes more involved, and, with the loss of central control over the facial muscles, the features become apathetic and the speech thickened, monosyllabic, and confused, as if the patient were drunk.

The lack of coördination is also seen in the staggering gait. A patient at the onset may move along mechanically, heeding no one, with a vacant, stupid expression on his face, until he falls, or without knowing it goes to bed and removes his clothing automatically. Or, by an effort of will, he may go about his duties in a semi-dazed condition with high temperature and rapid pulse. In my own case, I remember I had promised to inoculate some patients against typhoid, and, though knowing I was ill and suspecting it was plague, I fulfilled my engagements, sterilizing the syringe in a semi-mechanical way, and feeling much as if I had taken a massive dose of quinin and it had made me stupid and produced singing in the ears, etc., until at length extreme weakness compelled me to give up. Or the nervous disturbance may pass into active delirium, sometimes of a maniacal form with suicidal or homicidal tendencies. The patient finally when exhausted sinks into lethargy and coma, and is usually resentful if an attempt to rouse him be made. Insomnia with intermittent drowsiness is not infrequent.

By the second or third day the fever is generally at its highest, and, unless complicated by new glands being involved or a septicæmia, it begins on the fifth or sixth day to fall by lysis. This takes generally seven or eight days, and with its subsidence the head-

ache disappears. Often the fever drops a little on the fourth day to rise again before the true lysis occurs. The extremities are usually cold throughout the high fever.

Hemorrhages in the skin, and secondary "black boils" beginning as a red spot over the buboes, have not been seen nearly as much in modern times as would seem to have been the case in the plague of the fourteenth and seventeenth centuries. The petechiæ often described then as "the fatal tokens," though sometimes met with, are by no means the general rule.

Suppuration of the buboes may take place in the second week or they may resolve without breaking. Often they slough *en masse* and leave the muscular tissues beneath exposed as if they had been dissected. These sinuses are extremely indolent and often take many months to heal, and the prolonged suppuration may exhaust the patient or bring on death secondarily through waxy degeneration of the internal organs.

Hemorrhage from the nose, mouth, or female genitals is not uncommon, and in pregnant women abortion usually occurs.

There is a decrease of red blood-cells; leukocytosis is present.

Recovery is extremely prolonged and tedious. Plague toxin seems to have a special predilection for the nervous system, and thus in many respects resembles influenza and diphtheria.

The sequels of plague are usually dismissed by the authorities in a few lines, though they are of considerable importance. For some time I have been collecting instances from the cases which came under my notice in India, and am surprised to find how varied are the nervous lesions found in those who recover from the disease. Here, however, one must content one's self with a mere enumeration of some sequelæ more generally met with. Inflammatory changes in lens, choroid, or cornea involving loss of vision; iritis from a mere dulling of the pigment to a complete occlusion of the pupil; staphylomata and keratitis and various paralyses of external ocular muscles—these are all frequent eye complications.

Deafness in one or both ears; aphasia due sometimes to defective memory, remaining long after the illness, or to want of coördination. Aphonia due apparently to paralysis of nerves involved. Marked muscular paralysis of limbs; paralysis of the palate and of the muscles of the vocal cords resembling those seen after diphtheria.

Peripheral neuritis, muscular tremors, and catalepsy have been described. Persistent tachycardia and long continued heart weak-

ness with giddiness and fainting which may last for one or two years, are by no means rare features. The suppurating buboes are often many months in healing. Even when they resolve without suppuration it is frequently a considerable time before they disappear, and after any unwonted exertion or in damp weather, for a year or more after the illness, they may become painful. The "good-for-nothingness" is extraordinarily prolonged. Many patients tell one that for two years any great mental or physical exertion speedily exhausted them. A feature not uncommonly elicited is that after a moderate day's work they *suddenly* become extremely fatigued about 6 or 7 P.M., and any duties after that time are performed laboriously. Functional cardiac irregularity speedily reappears through any extra strain, climatic or mental, put upon the patient.

In the *pneumonic* variety the dulness is patchy and lobular; the sputum thin, serum-like, abundant, and blood-stained, never the rusty appearance of normal pneumonia. The patient appears much more seriously ill than the physical signs would suggest. Fever is high and often intermittent. Delirium is almost always marked. Moist sounds are heard. The sputum is loaded with bacilli.

*Ambulatory Plague and Pestis Minor.*—The patient may have slight fever and swelling of glands but able to go about. Yet in the former, at least, the plague organisms can be recovered from the urine. Such mild cases often precede true plague epidemics.

*Septicemic plague* is a generalized septicemia caused by the specific bacillus and may be primary or secondary to some other form.

The termination of plague may take place by recovery, or by death through exhaustion caused by repeated hemorrhages, syncope after sudden exertion or violent delirium, or asphyxiation by pressure of buboes on the wind-pipe. Death by heart failure is commonest and is ushered in by small, weak, irregular, and frequent pulse. The extremities are cold and lips blue. Or the end may come by septicemic or pyemic processes overwhelming the patient.

#### DIAGNOSIS

The most reliable method of diagnosis is by bacteriologic examination and experiments on animals. The bacillus can usually be got from the blood of the finger-tip by an expert, but any one at all

acquainted with modern methods can usually be successful in obtaining it from the substance taken from a bubo or the sputum.

After the skin covering a bubo has been sterilized, a sterile hypodermic or antitoxin syringe-needle should be plunged into the gland substance and some of the effusion withdrawn and spread upon a clean cover-glass. Fix by immersing a minute in equal parts of ether and absolute alcohol and stain in Löffler's methylene blue or weak carbol fuchsin. With  $\frac{1}{12}$  inch oil immersion lens the short oval bacilli more deeply stained at ends (that is, bi-polar staining) are seen.

If the living bacilli are planted in mildly alkaline or neutral peptone broth to which a few drops of cocoanut oil or butter are added the so-called "stalactite" down growth from the oil droplet is seen. So far no other organism, I believe, has been described which shows this growth.

The bacillus takes the stain of all aniline dyes and is *not* decolorized by Gram's method; this in the case of sputum serves to distinguish it easily from *Diplococcus pneumoniae*, which is decolorized by this method.

Valuable points in the clinical diagnosis are the very rapid pulse (130 to 140 or more), the injected eyes, the fierce or dazed expression and staggering gait, and of course the presence of buboes. As a rule the great tenderness of these swellings after the first day serves to distinguish them from chronic lymphatic enlargements.

#### PROGNOSIS

This depends much upon the variety of plague and the type present in the particular epidemic. The pneumonic, for instance, is much more fatal than the bubonic. A bubonic case becoming septicemic is generally fatal in a few hours. The fatal cases usually last but 3 to 4 days. If a patient therefore pulls through to the eighth or tenth day the prognosis of recovery is good. A rapid softening and flattening of buboes is usually of bad omen.

When the temperature falls on the fifth day by crisis the outlook is not nearly so favorable as when it comes down by lysis.

Any sudden movement of the patient, voluntarily or otherwise, makes the outlook much graver. In our own cases we usually regarded it as an axiom that if a patient insisted on sitting up, the illness would prove fatal within 24 hours of such indiscretion.



## PROPHYLAXIS

The best personal prophylaxis against plague is inoculation with Haffkine's "vaccine." The dose is 5 c.c. for adults and 1 to 2.5 c.c. for children. Immunity is not established till 8 to 10 days after the injection has been made. Indeed, in all probability during those ten days there is lowered resistance toward plague infection, and therefore the patient should be warned not to expose himself to the risk for that length of time. Mr. Haffkine told me that he thought it protected in many cases for 12 or 18 months, but the undoubted protection can only be stated as 6 months. The following statistics of inoculations at Dharwar, India, are convincing:

		Attacks.	Deaths.
Inoculated once .....	5712	69	31
Inoculated twice .....	3349	9	5
Not inoculated .....	5614	957	756

It would seem well, therefore, to secure the maximum protection, to give a second injection about one month after the first.

Houses in which plague occurs should be thoroughly disinfected by formalin or some other powerful disinfectant. Corpses should be cremated. Contacts should be kept in quarantine 10 days, and patients isolated 4 weeks. Rats should be destroyed either by catching, poisoning, or rat virus as used in Odessa. (*Vide* Dr. Danysz's article in *Brit. Med. Journal*, April 23, 1904.)

Doctors and inspectors should wear close-fitting gaiters or puttees and thick socks and trousers.

As a matter of course the hands will be washed in corrosive lotion after contact with patients.

## TREATMENT

The specific treatment by antiplague serum has not yet justified the expectations entertained of it. Like in the days of Defoe many "infallible preventive pills," "sovereign cordials," and "royal antidotes" are widely advertised in countries where plague is epidemic, but so far the treatment is mainly symptomatic.

Good nursing is essential, and, remembering the profound cardiac involvement, any physical exertion or excitement must be strictly prohibited. The patient should lie with head low and not be allowed under any circumstances to be propped up or sit up

until at least 14 days after commencement of the fever. Strychnin and cardiac tonics should be given in doses far exceeding those given as the maximum in the books; until, indeed, there be physiologic response. The battle is to keep the heart going for 5 to 10 days; if that is achieved the victory is practically insured.

It will not do in the early days to rest on the slow absorption from an irritated stomach. Hypodermic medication with stringent antiseptic precautions must be resorted to every two to four hours at first.

The tincture of digitalis and of strophanthus are ill adapted to hypodermic administration and, as I can personally testify, are intensely painful to the patient.

Strophanthin ( $\frac{1}{16}$  to  $\frac{1}{16}$  grain, 0.0004 to 0.0006 gram), digitalin (digitalinum pulverisatum purum germanicum,  $\frac{1}{16}$  grain, 0.0006 gram, or more) and strychnin ( $\frac{1}{4}$  to  $\frac{1}{16}$  grain, 0.0016 to 0.002 gram) can be used alone, combined, or alternated.

When liquids can be retained the liquor strychninæ (B.P.) in doses of 15 to 20 minims (1 to 1.25 c.c.) or more can be given. It is surprising how large are the doses a patient stands before any physiologic effects show themselves. I believe that the hospitals where the percentage of recoveries has been large are those where these drugs have been boldly pushed.

For the pyrexia cold sponging is invaluable, and nothing relieves the intense headache better than ice-bags or iced cloths frequently applied. The usual antipyretics are contraindicated in the severe cardiac involvement and the shock of cold sponging may have to be combated with champagne, brandy, or other alcoholic stimulants.

Insomnia may be dealt with by sulphonal or bromides, but often the only effective drug is morphin hypodermically. Thirst is greatly relieved by sipping iced lime or lemon water or frequent rinsing of the mouth with glycerin and lime-juice. The dryness of the tongue and lips is made more tolerable by rubbing on them an ointment of white vaselin with one drop of peppermint oil to each dram of vaselin.

An ice-bag, evaporating lotion, or belladonna and glycerin, applied to the buboes will diminish the pain. They should not be incised until suppuration has taken place. The streptococci present are believed to starve out and kill the plague bacilli, therefore, if

left until suppuration has well advanced there is much less risk of the bacilli entering the blood stream through an incision and causing a general septicemia. I think powdered charcoal is one of the best dressings for the indolent ulcers left after opening the bubo. Its deodorizing as well as antiseptic qualities are valuable. Calomel and enemas may be necessary if there be constipation. Of course, the bed-pan must be used.

The food is what is usual in fevers, mainly milk, etc., and as soon as convalescence begins must be as full and nourishing as possible. Ice-cream if really made with cream is a nutritious and pleasant change which seems to agree well. All alcohol should be abandoned after the critical period is passed. The main axiom throughout is fearlessly and persistently to push the cardiac stimulants during first 10 days.

The tedious convalescence is benefited by iron and strychnin and phosphorus, and by abundant rest and sleep, and change of climate, especially to glacier and high mountain air.

Work should not be resumed until the patient is quite strong, as recuperation is always very slow.

## SEASICKNESS, WITH SPECIAL REFERENCE TO ITS PATHOGENY

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BEFORE discussing the nature of seasickness, a few words as to symptomatology and empiric etiology are necessary, on account of some prevailing misapprehension. First of all, nausea and vomiting are by no means as conspicuous symptoms as is popularly supposed. Indeed, the characteristic symptom is a wretched feeling of languor and depression, mental and physical, and with genuine cardiac depression. The patient may sleep or doze for hours in the same posture. He suffers no pain, there may be no vomiting, not even retching, no dizziness, no desire for food or water or anything else, unless it is to die, and yet the patient is not comfortable, but in a subdued agony of malaise. This characteristic symptom of nervous depression is usually felt in a mild and comfortable form by all on board a ship, unless, perhaps, by small children. Even experienced sailors seem to feel it to some degree, and, indeed, the standard of work demanded from officers and crew is considerably less, on the average, than is required even from the union laborer on shore.

The popular conception of seasickness is correct to this degree: at the beginning, the stomach is emptied of its contents, and whenever food, drink, or secretion are present in any notable quantity, the stomach empties itself until the seasickness abates. After the stomach has been squeezed dry, the vomiting and usually the retching subside entirely until there is something to be discharged, when the predilection for the cardia instead of the pylorus again becomes manifest. Bile is almost always regurgitated, but there seems to be no tendency to reversed intestinal peristalsis, such as would cause fecal vomiting. The bowels are almost invariably constipated and the kidneys and skin inactive, though the latter fact may be due to the usual coolness of the air, and both conditions are largely ex-

plained by the dread of exciting vomiting by drinking, and by the expulsion of water before an opportunity has been afforded for absorption.

In spite of the derivation of the word nausea, it does not seem to me that it is especially characteristic of seasickness, although it exists in many cases, and the word is carelessly used by many persons to describe any tendency to vomiting. Very frequently, if not usually, the vomiting first appears as a pure motor reflex. The patient may have no idea that he is going to be seasick; he belches a little gas, without nausea or depression, then follows water-brash, the liquid raised varying greatly in taste, acidity, etc., according to the food and drink previously taken, and various other factors which need not be discussed here. Then follows a determined effort on the part of the stomach to wring itself dry, and the victim realizes that he is seasick. Even at this stage there may be no especial depression, no real nausea, and the patient may even feel hungry and enjoy the thought and odor of food. Sailors almost unanimously advocate eating and drinking until the stomach becomes tired of rejecting its contents. I must confess that this advice does not appeal to me as rational, either from the stand-point of physician or patient, although there is no question that one with strong will power may conquer seasickness in this way. Whether the conquest is more rapid than by adopting the opposite policy, I do not know; but it is in accordance with sound general principles not to put food into a stomach which rejects it.

The essential cause of seasickness is the motion of the boat. Seasickness is, therefore, of the same nature as similar sickness due to the movement of a swing, hammock, car, elevator, etc. Cases of seasickness even developed from the oscillation of the otherwise stationary air-ship which purported to carry passengers from the Midway of the Pan-American Exposition to the moon. It may seem unnecessary to emphasize this point in the etiology, and, indeed, it is almost unanimously conceded as a general proposition, but in particular cases there is an inexplicable reluctance, even a sense of shame, at confessing to actual seasickness, and all sorts of chemic and reflex excuses are offered. The patient is not seasick, but he has been greatly fatigued and his stomach has been upset for some days, or the dining-saloon was close, or the fish was tainted, or he has taken a glass too much of some beverage, or he has seen

some one else vomit, or the reflection of sunlight from the waves has made his head ache, and he has become nauseated as a result. In short, anything on earth, or, rather, on the water, is suggested as a cause of the seasickness except the real cause.

Of course there is no reason why any of the ordinary causes of vomiting should not operate on shipboard, and irregular or badly prepared meals eaten by travellers, or farewell banquets, often produce gastric disturbances resulting in vomiting before the ship is out of perfectly smooth water. Many persons anticipate seasickness and produce vomiting by self-suggestion almost as soon as the ship is under headway. I have seen a stewardess lean over the rail in New York harbor before the motion of the boat was perceptible, and, although she was able to do her work pretty well when there was some actual reason for seasickness, the psychic impression persisted for several voyages, and she was obliged to abandon the position. Obviously, any of the ordinary chemic or psychic causes of vomiting may operate to determine the onset of seasickness or to increase it when developed; but, in the aggregate, there is no question that the disease is due to the instability of the horizontal, that it develops in spite of the conviction that it will not, that it often fails to develop in those who expect it, that it does not depend directly upon the condition of the general health or of the stomach or of the stomach contents, and that the various factors, aside from motion, play a very minor part as subsidiary, exacerbating causes.

Seasickness depends, like every other disease, to some degree upon an unexplained idiosyncrasy, and in nearly all cases the tendency may be lost by getting used to the motion. But veteran sailors are by no means always immune. As has been intimated, the idiosyncrasy does not coincide at all with the nervous temperament, with general health, or even with the ordinary state of the digestive organs. Strong, hearty men, without having perpetrated dietetic sins and who have ridiculed the thought of being seasick, may suffer terribly from the slightest movement of the ship, and weak, nervous, dyspeptic women who have resigned themselves to a week of seasickness for the sake of reaching the opposite shore, may escape entirely and eat like a sailor. The immunity acquired by habituation may be expected after four or five days in most instances, at least so that the symptoms persist only in mild forms, and this immunity may last so as to protect from a recurrence after

several weeks on shore, but it seldom lasts from one year to another. Moderately rough weather is usually more likely to cause seasickness in occasional passengers than a genuine storm, perhaps because of the exhilaration or fear due to a storm, perhaps because the body has time to adapt itself to a wide excursion of movement, but not to one of smaller radius. Seasickness among the officers and crew, however, usually occurs only in a storm, because they become accustomed to moderately rough seas, but do not experience genuine storms often enough to acquire habituation. For the same reason, veteran lake sailors are often seasick at sea, and *vice versa*, or seasickness may develop on transferring from a large to a small boat.

It is scarcely necessary to state that seasickness does not depend directly upon the height of the waves, but upon the motion communicated to the boat. Thus, a sea that would cause nausea in the occupants of a small boat does not affect the passengers of a large one. The same sea striking the stern of a boat and helping it onward causes much less motion and, consequently, much less seasickness than when the boat is going in the opposite direction, so as alternately to ride over and dip beneath the waves. And the same sea rolling the boat laterally, as when the boat is in the trough of the waves, causes much more motion and seasickness. Indeed, perhaps because we are accustomed from experience on land to more or less oscillation of vehicles in the anteroposterior diameter, a transverse movement causes relatively more seasickness than the same amount of movement in the long axis of the ship. Sailors claim that it is inviting seasickness to lie crossways of the ship, without reference to the direction of oscillation. This is not in accord with theory, but I am unable to contradict it empirically. It goes without saying that the amount of seasickness depends upon the construction of the ship. Thus, the narrow, fast boats roll much more than broader, slow boats, especially when the latter are equipped with bilge keels, which are long wings, below the water-line, extending nearly the whole length of the ship at each side and offering an enormous resistance to any force tending to lift or depress the ship laterally. As the wave length of any fluid is fairly constant, a short boat, riding only two or three waves, is much more subject to an anteroposterior pitching than a long boat which rides four, five, or six waves at once. Much depends also upon ballasting and cargo. Both engineers and navigators have assured me

that two ships constructed on exactly the same model, with similar engines and equal cargoes, present individual differences of seaworthiness, and that there is a basis of truth in the sentiment which Kipling has embodied in his tale of "The Ship that found Herself." This reminds one of the pure superstition that a ship carrying priests or nuns is destined to a rough passage with much seasickness. This superstition dates at least as far back as the time of Jonah. From personal observation I can attest (1) its accuracy, and (2) its entire inaccuracy.

With reference to the relief from seasickness by habituation, there may be mentioned a psychic symptom of considerable importance, not characteristic of seasickness, except in a general way, but applicable to any condition which depends upon a repeated cause. Before the system becomes at all accustomed to the motion, there is an almost intolerable nervous protest against the fact that the motion does continue without cessation. Without reference to the actual condition produced, the mere fact of the continued motion becomes fatiguing and exasperating. This feeling is essentially the same as when one has to listen to a noise that continues or is repeated without cessation, or when one is forced to observe some unfamiliar nervous trick of a companion, or when one is riding against a head wind, even in a vehicle other than a bicycle, so that the mere increase of labor is not a factor. Other illustrations will occur to one. This element naturally assumes importance in direct ratio to the nervous temperament of the patient. It is conceivable that temporary insanity might develop as a result, though I have never heard of a case. I have, however, seen marked hysteric symptoms develop, and even patients of comparatively strong minds may express the utterly unreasonable desire that the boat might tie up at an island in the well-charted Atlantic where one has never yet been discovered, or pray for a special dispensation that might allow them ten minutes of freedom from the interminable and intolerable motion of the ship. This feeling does not seem to increase the ordinary symptoms of seasickness, nor is it entirely confined to the seasick. Indeed, persons who are never seasick, have complained bitterly of the vibration of the fast boats, without any particular reference to the motion due to the waves; and I have been surprised to hear men apparently free from nerves say that they would never again cross on a fast boat, solely from the discomfort of this nature.



Let us now consider the pathogeny of seasickness. Obviously, a morbid anatomy is not to be expected, except in the sense that a functional disturbance theoretically involves some actual organic change which our present histologic methods do not disclose. On the other hand, while seasickness is a neurosis, it is by no means one of the kind that can be described by the adjective *neurotic*. Undoubtedly a neurologist can suggest a better and more technical description, but it may be characterized as belonging to those neuroses which are based on a rational and genuine reflex, and not to those in which the essential element is that vaguely understood lack of nervous coördination which we designate as hysteria. Seasickness is not an organic nor even an essential functional disturbance of the stomach. It cannot be controlled to any degree by dieting, except in the superficial sense that the stomach usually becomes quiescent when it is empty and except that an ordinary dietetic disturbance of the stomach may be mistaken for or may coexist with seasickness. Neither can seasickness be mitigated by medication directed at an imperfect digestive function, at an excess of germ activity in the stomach, nor by local gastric sedatives and anodynes. On the other hand, any general anodyne, including, of course, large doses of cocain, atropin, chloreton, and other drugs which in moderate dose may be used as gastric sedatives, is efficient, subject only to the general liability of any drug to fail of its desired effect in an individual case. As a general rule, the severity of the symptoms is not sufficient to justify the use of large doses of morphin nor the saturation of the system with bromids in advance of a voyage, nor any similar, efficient sedative medication. On the contrary, I have seen cases in which general stimulants, such as strychnin, were urgently indicated not only by the symptoms, but by the quality of the pulse.

As has been stated, the dominant feature of seasickness is one of general nervous depression, often justifying the term collapse, and quite comparable to surgical shock. The irritability of the stomach, which has been stated not to be so conspicuous a feature as is usually believed, stands out in marked contrast to the inactivity of all other functions, with perhaps the exception of the secretion or, at any rate, expulsion of bile, and possibly the functions of secreting glands that have not been investigated. From a few personal observations and inquiries made of intelligent patients, I am in-

clined to believe that the secretion of hydrochloric acid is usually in abeyance, so that the gastric irritability may be considered, pending more accurate investigations, as limited to the motor phenomena, the secretory function agreeing with the general state of depression.

Although the vomiting and retching usually cease when the stomach is entirely empty, these motor phenomena do not seem to represent a local, motor reflex. This view is strengthened by analogy, for there is no similar reaction between intestinal contents and peristalsis, nor between urine and bladder, there being almost invariably a marked constipation and, at least, no increase of normal vesical irritability, even allowing for the diminished secretion.

The vomiting of bile and the complaint of pain in the region of the gall-bladder sometimes made suggest that there is the same unrest of the gall-bladder as of the stomach. In surgical and ordinary medical shock and collapse, we have the same exception to the general quiescence of function, and it seems proper to regard the gastric symptoms of seasickness as a centric reflex in the sense that the trouble is not entirely local.

As an exciting factor in the production of this reflex, eye-strain or, at least, equilibratory impressions by way of the eyes, have been considered excito-reflex and as essential causes of seasickness. I have no theoretic argument against this theory, but persons who are blind or who are amaurotic on account of cataract, corneal ulcer, etc., are not immune to seasickness; closing the eyes does not affect a cure, although, of course, a person lying down is freer from symptoms than one walking about or sitting up, and one usually closes the eyes when lying down. Neither does seasickness subside to any noticeable degree after dark, excepting, of course, after bedtime. I have noticed personally that I could read while seasick, providing the head was kept low. On the other hand, there may be, on sea as on land, dizziness from eye-strain, and the psychic effect of watching the swaying of the ship may be unpleasant. Yet neither eye-strain nor equilibratory impressions received by vision can be considered as the essential elements in the production of seasickness.

Seasickness has been ascribed by some to the strain of muscular coördination and "disappointment" of muscular effort. But it persists when there is no voluntary use of the voluntary muscles, and it does not occur when similar disappointment occurs from

optical illusions which prevent accurate gauging of distances or in attempting to grasp or touch moving objects when the individual is on a solid floor.

With more physiologic probability, seasickness has been ascribed to the inertia of the liquid in the semicircular canals; and I am inclined to accept this theory to some degree, especially as experiment shows that certain movements, notably in a circle, produce dizziness, weakness, and nausea, or even vomiting. Still, this theory does not explain individual exemptions from and predisposition to seasickness so well as the one that will be advanced; seasickness may be prevalent when the movement of the boat is only five degrees either side of the horizontal, as shown by the clinometer, and this variation is well within the ordinary limits of movement of the head. Indeed, movement of the head in any direction, within about ten degrees, may be maintained for a considerable length of time without inducing seasickness. Finally, if seasickness is solely or mainly due to the semicircular canals, it is difficult—and for myself, impossible—to explain the marked relief which accompanies the prone posture.

My own conviction is that, normally, our ideas of direction, motion, etc., are very largely due to the inertia of the liver and to a less degree of the other large viscera. It will readily be appreciated that the physiology of the sense of equilibrium and direction, according to this theory, is precisely the same as for that ordinarily taught, except that there is substituted for the minute quantity of light liquid filling completely the walls of its container, a solid organ weighing about three pounds and comparatively loosely contained in a yielding receptacle—not to mention the assistance of this function that may perhaps be ascribed to other organs—and by substituting for the branch of the eighth nerve, fibers of the pneumogastric. The inertia of the liver can be plainly felt in an elevator and often in making various sudden horizontal movements. This theory also explains, rationally, the connection between nausea and vomiting and disturbances of equilibrium, on the ground that the reflex is in the area of the same nerve. Cardiac depression is similarly explained. On the other hand, if we assume equilibratory impressions to be solely due to the semicircular canals and their nerve-supply, we have no explanation of the gastric and cardiac reflexes other than the diffusion of nervous impulses on account of

an accidental contiguity of medullary centers or a purely arbitrary association, not explicable on any hypothesis of evolution from an essentially conservative reflex.

With special reference to seasickness, it is difficult to imagine anatomic differences either of the semicircular canals or of their nerve-supply, which would explain differences of susceptibility, and we are forced to postulate merely a receptive difference of the centers. If, on the other hand, we assume the liver to be the main source of equilibratory impressions, it is not only possible to offer the theoretic explanation that a difference of susceptibility to seasickness might be due to an anatomic difference in the fixity of the liver and the sensitiveness of the nerve-fibers connected with it, but we can also see why the reflex should occur in other parts of the pneumogastric distribution. On this hypothesis, we also have a ready explanation of the tremendous depression which is the essential element in seasickness and of the amelioration of the symptoms produced by the recumbent posture which limits the sway of the liver and relieves the nerve-filaments of any strain in a vertical direction.

I would scarcely go so far as to claim that seasickness is a manifestation of movable liver in the anatomic sense, though it has happened that a few of the very worst cases that I have seen have occurred in women who had nephroptosis and the general indications of a splanchnoptosis, and that a tight abdominal bandage has given marked relief in these cases. But it is unnecessary, in support of this theory, to postulate an absolute pathologic movability of the liver. Every liver is more or less movable within the body, so that it will, by inertia, start to move a little later than the body as a whole, when the body is subjected to a rocking motion, and it will continue in motion for a moment after the body has come to a stop. This inertia tends to produce an impression upon pneumogastric and, of course, on sympathetic filaments. But the reflex produced depends also upon the sensitiveness of these fibers. Precisely an analogous condition exists in regard to movable kidney. Few will contradict the general statement that movable kidney produces a mild state of shock of the sympathetic system by mechanic influence. Yet we find many cases in which a very loose kidney produces practically no nervous symptoms, and we often bring about a fairly permanent symptomatic cure by bandaging the abdomen

for a time so as to relieve the nerve-fibers of the mechanic insult, and thus allow the nerves to recover their tone, if this expression be understood in a rather figurative sense. Conversely, we find cases of extreme nervous susceptibility, with the kidney only slightly movable. The relative immunity of children from seasickness may be explained partly on the ground of the less absolute inertia of their livers. At first thought, it might seem that children, having relatively larger livers than adults, should be more disposed to seasickness, but such an argument would be on the same line as to say that a man should be able to jump as far as a flea in proportion to his stature. But a better explanation of the relative insusceptibility of children is that their nerve impressionability is less, and that they are, on account of the elasticity of their tissues and especially their thoracic wall, habituated to the mechanic force of hepatic inertia.

It may not be out of place to say a few words as to the prognosis of seasickness, especially as it is ordinarily regarded as a laughing matter. Brief equilibratory nausea, whether produced in an elevator, swing, or hammock, by an earthquake, in a trolley-car or train, or literal seasickness of not over 24 hours' duration, is not usually of serious import, although, like any other minor disturbance, it may overthrow the balance in the aged or otherwise feeble. We must also recognize the possibility of serious or even fatal results from immediately local phenomena of vomiting and retching, in cases of aneurism, including minute cerebral vascular changes, of gastric ulcer, gall-stones, renal calculi, pregnancy with susceptible reflexes, hernia, impending intestinal incarceration, hepatic or other abscess, etc.

Marked and protracted seasickness may be much more serious. I have seen a case of sudden death on shipboard, which seemed to be due to pulmonary edema. The patient was a girl of 6 years, slightly seasick during the day, apparently well during the evening and at bedtime, and in a dying condition at midnight. I ascribed the death to "thymic asthma" (whatever that term may really mean) on account of the suddenness of the attack and enlargement of the gland. But after death three large lumbricoids crawled from the nose, and it is just possible that the pulmonary condition was due to the presence of the worms which had been brought up by the retching and vomiting. They did not, however, cause death

by direct asphyxiation, and they may have had no part in causing the edema.

On the "Vaderland" in the winter of 1904-05, 12 deaths in the steerage were at first attributed to the depressing effects of seasickness acting upon a constitution already enfeebled by privation. Pneumonia was subsequently found in the bodies brought to land, but it is possible that the depression really determined the incidence of the disease or its fatal outcome.

It is said that in some disasters at sea, persons who might otherwise have been saved were so indifferent on account of seasickness that they made no effort in their own behalf. On the other hand, in the face of real danger or other excitement, seasickness may disappear. Undoubtedly, too, some suicides at sea, especially when marked by temporary aberration of mind, have been due to seasickness, and numerous fractures, dislocations, bruises, and drownings, especially among inexperienced members of the crew, have been determined by the weakness of seasickness, whereas a well man could easily have withstood the lurching of the ship or impact of a wave that directly caused the accident.

Seasickness of many days' duration may become serious simply because of the impossibility of taking nourishment, though most travellers are overfed and are benefited by the fast. But, from personal experience, I am convinced that the popular notion that seasickness vanishes when one reaches shore and that the appetite immediately returns, and with it the strength, is not entirely correct. On the contrary, weakness, loss of appetite, and general abeyance of function may persist for several weeks, even with none of the more serious lesions already considered.

Prophylaxis and treatment have already been considered. A calomel purge and light diet immediately before a voyage and especially an avoidance of the too prevalent farewell indiscretions are to be enjoined. It is a mistake to fight too strenuously against the languor induced by the voyage and to take advantage, as so many professional and business men do, of the freedom from responsibility, to go upon a protracted spree. One of the prominent members of our profession a few years ago made himself conspicuous by being continually drunk from the time that he was assisted up one gang-plank to the time that he was carried down the other. And yet such thorough indulgence in alcoholics may effectually prevent seasick-

ness. But the man who goes on board, just sobered from a temporary excess, is almost certain to develop the symptoms of seasickness, though we may question whether the condition is not often the same kind of digestive disturbance that might occur on land.

Many persons remain in their berths or state-rooms till the last day of the voyage. If the room is well ventilated, there is no special objection to this course; but, on the whole, an open-air life, with warm coverings and heaters if necessary, and an avoidance of too much eye-strain, is preferable. Some persons can eat on deck, but are nauseated if they attempt to eat in the dining-room.

Various drugs have enjoyed greater or less vogue as preventives of seasickness. The chief ones are bromids, coal-tar antipyretics, opiates, chloral, chloreton, etc. Such anticipatory drugging is often miserably unsuccessful. Even if apparently successful, one can never be certain that the patient might not have escaped without the depressing effect of the drug. I have no doubt that the drugging does prevent many cases of sickness, but question seriously its justifiability.

Treatment consists in rest, in nearly or quite horizontal posture, avoidance of chill, withholding of food; strychnin and easily digestible and supporting food when weakness becomes marked, bandaging of the abdomen if any splanchnoptosis is manifest—or, if it can be done without too much fatigue to the patient, in any case,—and such general nerve sedatives as may be selected in severe cases.

# Surgery

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## THE PATHOLOGY AND TREATMENT OF THE HERNIAS OF CHILDREN AND THEIR RELATION TO SIMILAR CONDITIONS IN THE ADULT

A POST-GRADUATE LECTURE DELIVERED AT THE HOSPITAL FOR SICK CHILDREN, GREAT ORMOND STREET, LONDON, FEBRUARY 11, 1904.

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GENTLEMEN: In selecting a subject for this lecture, I have been desirous of bringing to your notice some points in connection with some common disorder, which may be seen and tested almost in every day of practice. One of the most frequent ailments seen in the Out-patient Department, that is, hernia, has been taken. An endeavor has been made to throw light upon the origination, the treatment, and the after-effects upon adults. In this way I hope to convince you that childhood is the time when an operation has the best chance of curing a hernia, as then, and then only, is the surgeon's skill aided by Nature in the subsequent growth of the subject. Childhood is the period when we may hope to do a little more than "put back the hands of the clock." We may be able to do a good deal toward the local "winding up again of that clock."

Amongst the out-patients who attend the practice of a Hospital for Children there are a large number of cases of hernia. And so I have selected this opportunity of bringing before you several points of interest in their pathology and treatment which are largely new. It requires but little discrimination to see that there are two great factors in the production of the hernias in children. One, a predisposing condition, is a congenital malformation, by



means of which the tunica vaginalis of the testis and the peritoneal cavity remain in communication with each other, the so-called congenital sac, consequently allowing the easy descent of such abdominal viscera as can migrate. The second factor, the one which actively produces the hernia, is the association of hernias in children with gastro-enteritis, or better, gastro-intestinal fermentation with the production of gas, the consequent distention of the abdomen and the increase of intra-abdominal pressure. As a result, the weaker parts of the abdominal wall yield, one or more hernial protrusions appearing. It is quite common to see multiple hernias in children, such as inguinal and umbilical, which are the consequences of this distention. The large hyper-resonant belly and the multiplicity of the results obviously point to the general, rather than the local, character of the method of origination of these protrusions. The presence of rickets, the passage of offensive stools, etc., indicate the incapacity of the child to digest its food, whether the fault lies with the child, the food, or both.

#### THE HERNIAS AND HYDROCELES OF CHILDREN

In order to illustrate the relative importance of these two factors, the predisposing or passive and the active, I wish to call your

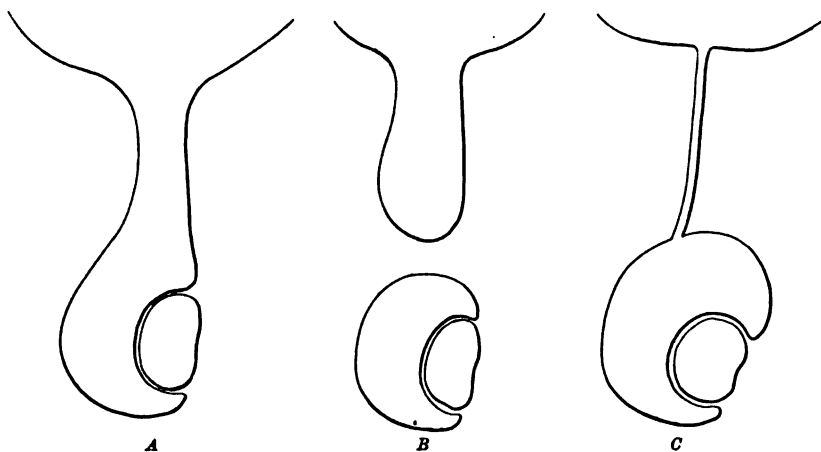


FIG. 1.—A, congenital hernial sac; B, acquired hernial sac; C, hydrocele of children.

attention to the following points: The first deals with respect to the very great frequency of the presence of a communication between the tunica vaginalis and the peritoneal cavity, that is, the

congenital hernial sac, which exists in the condition recognized as hydroceles in children. Careful inquiry or the direction of the mother's attention will reveal the fact that the hydrocele is less tense in the morning than it is at night; that is to say, after the child has been lying quietly and some of the fluid has found its way through a communication, from the tunica vaginalis to the peritoneal cavity, the scrotal swelling becomes slack. And again, the more frequently and carefully this communication is looked for during the course of an operation, the more frequently it is found. The presence of this strait or neck can be demonstrated as a distinct thickening in the cord of that side in a patient attending the Out-patient Department. (Fig. 1.)

Yet again, recent hernias in adults are found to have congenital sacs. Therefore, the presence of a communication between the tunica vaginalis and the peritoneum, alone, is insufficient to cause the formation of a hernia. It would therefore seem, as would be expected, that the increase of intra-abdominal pressure, the active factor, is more important than the predisposing malformation. Again, when operating on the hernias of young children, the observer cannot but be impressed by the frequency of the occurrence of sacs of acquired or recent origin, that is, unconnected with the tunica vaginalis.

These considerations have led me to place the greatest importance on gastro-intestinal fermentation in the causation and the production of hernias in children; and to look upon congenital malformations of the tunica vaginalis as merely important conditions predisposing thereto. Upon this view, the importance of dietetics for the prevention of gastro-intestinal disturbances is still further emphasized. The relation of these infantile hydroceles to hernias and gastro-intestinal troubles is one of the greatest importance, the result casting a lurid light upon the rationale of painting the scrotum with discutients in order to cure imperfections of digestion and the hernial sac of the hydrocele. Some observers have demonstrated the existence of fluid in the abdomens of children, the subjects of hydroceles. The fact that these hydroceles are in hernia sacs, potentially so if they have never actually contained an abdominal viscus, demands that the treatment should be that of hernias, which will be mentioned later, and demonstrates the utter futility of scrotal discutients.

## HERNIAS AND PHIMOSIS

To students of text-books and recent monographs, it will be at once apparent that no notice as yet has been taken of the almost universal and the most popular notion of the importance of phimosis in the causation of the hernias of children. That such may be the case in some instances cannot be denied. But I have rarely seen a case in which I could satisfy myself that such was in reality true. The urinary opening in the prepuce is rarely so small as to be of such paramount importance. Also, in such a condition, the prepuce itself would become ballooned and distended with urine during the act of micturition. (Fig. 2.) Such a phenomenon would

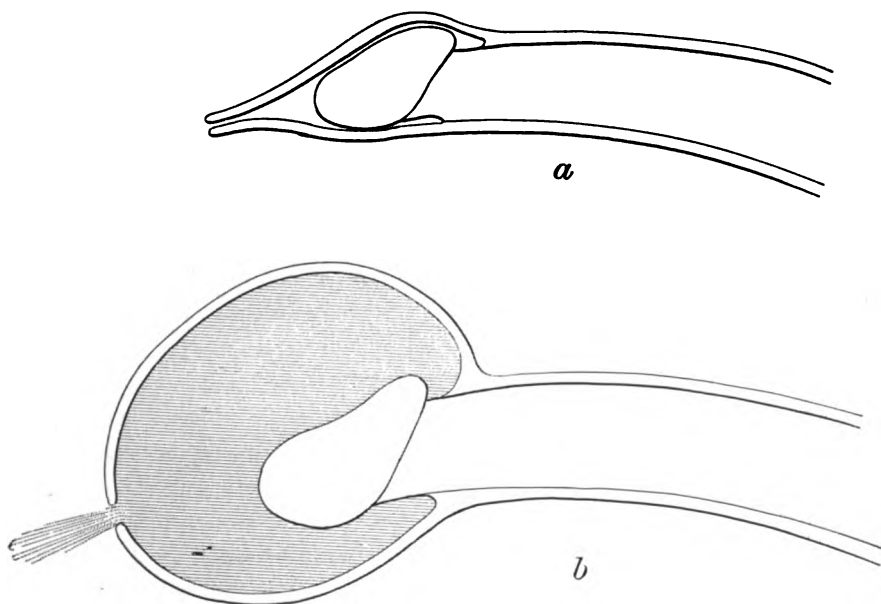


FIG. 2.—*a*, diagram of an ordinary case of phimosis; *b*, diagram of the distention of the prepuce occurring during micturition when the stenosis is at the preputial opening.

hardly be unnoticed by the mothers. Yet I have never been able to obtain such a history. Hence, with regard to the importance of phimosis in producing hernia, it may be affirmed that, from the evidence before us, the prepuce is a much maligned structure, and the operation of circumcision in this connection one which raises false hopes. The operation by itself is certainly very rarely followed by any improvement in the condition of the hernia. Circumcision must be combined with other treatment, and though an oper-

ation, and therefore of great importance in the eyes of the friends and the public, it should be pointed out that it is only of secondary value as compared with more direct measures, such as diet, medicine, etc. Doubtless this small operation is practised far more often than is necessary. In most cases it may be regarded in the light of a procedure of expediency rather than of necessity. If more attention were paid it would be noticed that a small meatus urinarius in the small glans penis is very often associated with a tight prepuce and is the true cause of the child's straining during the act of micturition.

#### THE ADVANTAGES, THE DISADVANTAGES, AND THE VALUE OF TRUSSES

To extend the above arguments further, and so cover more fully the subject of hernia-production in children, it may be pointed out that it is the continuance or persistence of the increase of the intra-abdominal pressure, such as that arising from gastro-intestinal fermentation, which gives rise to the formation of a hernia, rather than the sudden and more violent increments of pressure which arise from muscular efforts and strainings. In an adult the conditions seem rather to be reversed, as will be pointed out later.

The next point which I wish to bring before you is the curability of hernias by means of a truss. The truss has long been a popular remedy for ruptures, and especially those of children. But it has not been made at all clear how this result is brought about. So far as can be ascertained, it can cause matting of the tissues about the neck of the sac by means of the pressure which it exerts. And, perhaps, in a few instances, it may also cause obliteration of the canal of the neck of the sac by means of the formation of peritoneal adhesions. The situation of these adhesions will be well below the level of the peritoneum, and therefore will at best be comparable to the bad application of a ligature to the sac. Besides, by preventing the descent of abdominal viscera, it will prevent further distention of the sac and enable natural growth to assist in, and perhaps perpetuate, the "cure."

The most popular truss for babies and young children is the one constructed out of a skein of wool. It requires but little experience of it to demonstrate the general inefficacy of this form of truss. Still, it is of some use. The pressure of this soft truss is quite insufficient to bring about the obliteration of the channel of

communication in the neck of the sac. So that there can be no hope of curing the hernia by means of the formation of adhesions—that is to say, according to the ordinarily accepted method, as delineated above.

The second favorite is a spring truss, which consists of a girdle and a pad, somewhat like those used on adults. There are two main objections to the use of this truss: (1) The child is growing, and the truss never fits for any length of time, having to be replaced by a new one; and (2) as its pressure will be exerted on the structures of the spermatic cord as well as on the neck of the hernia, it will cause injury to the testis. Trusses used by adults occasionally give rise to orchitis in a subacute form; more commonly to fibrosis of the testis, which is the result of obstruction to the venous return. But the question assumes quite a different aspect when dealing with interference with the blood-supply of a developing gland tissue, such as that of the testis of a child. Orchitis, atrophy, and hardening by fibrosis, which will cause growth in the organ to cease, have been illustrated by cases among the out-patients. The importance to the individual of the testes before puberty has been strongly insisted upon in the lecture which I gave here in October, 1903. And as the subject is one the importance of which has never been appreciated, it is yet again insisted upon. The value of the testes from the point of view of the continuance of the race lies in their capacity for spermatogenesis. But, especially for the individual, there is another factor, namely, the perfection rather than the origination of the male characteristics, the so-called secondary sexual characters, such as the male form and strength of body, the beard and moustache, the voice, etc., which are supposed to need for their perfection some internal secretion of the testicle. If only one studies people with imperfectly descended testes, the conclusion that one must come to is that the perfection of the male characters may be estimated by the amount of perfect testicular tissue present. Many surgeons have referred in a light vein to the apparent prodigality of nature in the presence of bilateral organs in the male when one will insure the perpetuation of the race. The whole question turns on the fact that the production of spermatozoa is but one of the functions of the testicle. It is the external secretion. It is a fact amply proved, that the presence of one good testis will insure spermatogenesis,

and a little further study will convince the observer that the early atrophy of one testis will lead to some imperfection of the male peculiarities, such as deficiency of the growth of hair on the face, the high-pitched voice, etc.; and the earlier the age at which the atrophy occurs the more marked will be the deficiencies. After puberty, that is, when once these characters are developed, they seem to be more or less permanent, no matter what the subsequent conditions of the testes.

From the above it will be seen that considerable evil may result to the individual from the application of a too forcible truss, on account of its interference with the blood-supply of the delicate tissue of the growing testis. This being so, it seems that it will be impossible to cure a hernia, which has a congenital sac, that is to say, one in which the tunica vaginalis and the peritoneum are continuous, by means of a truss which will cause no harm to the testis; unless the natural separation of these structures which normally occurs before birth is merely belated. Yet it is known that a number of the hernias in children disappear and are cured. What is the explanation?

From what has been said above, it may be presumed that the hernias which are cured have not congenital sacs, these being apparently incurable short of operation. And my experience at the operating-table has already led me to believe that acquired sacs are a great deal more frequent in childhood than is supposed. It may therefore be suspected that the cases in which the hernia becomes cured are cases in which the sac has been of acquired origin. It is possible, though improbable, that these sacs can be cured by the obliteration of the neck of the sac by the pressure of the truss, whose pressure is such as not to injure the testis. But it struck me that there was another possible and probable explanation for this fact, and one which was of more extensive application.

The acquired hernial sac of children is produced largely, if not entirely, by the increased abdominal pressure caused by gas formation, due to fermentation in the intestines. When this fermentation subsides, under treatment or otherwise, the original cause of the protrusion ceases to exist. Now, as the child grows, the concurrent increase in size and capacity of the body will lead to the retraction of the acquired hernial sac into the abdomen; in this way it may be pulled up and the hernia cease to exist (Fig. 3).

The absence of a sac in the internal abdominal ring and the non-protrusion of viscera will enable that ring to grow normally and correctly, the growth correcting the deformity which has resulted from the hernia, exactly as it does in the case of the curva-

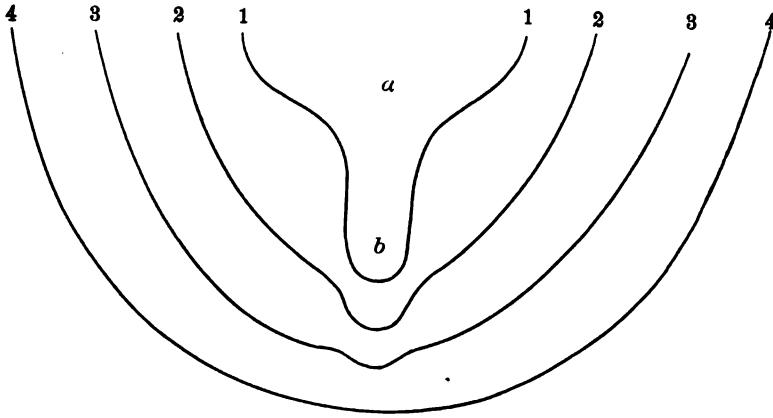


FIG. 3.—Illustrating the natural retraction of an acquired hernial sac by natural growth. 1-1 represents the first stage, *a* being the peritoneal cavity and *b* the hernial sac; 2-2, 3-3, and 4-4 represent successive stages of increase in size of *a* and retraction or disappearance of *b*.

tures of bones. It is, in the nature of things, not easy to bring forward positive or direct evidence in favor of this hypothesis, and I merely indicate the sources of evidence from which the conclusion was drawn:

(1) I have seen the apparent complete disappearance of inguinal hernia in a child, in which the testis was quite separate from it; presumably, therefore, the sac was an acquired one. This I have seen occur in cases treated both with and without the use of a truss. It has been seen in both sexes.

(2) I have operated upon one case in which there has been a most distinct history of a hernia in childhood, without finding any trace of it. This case was that of a woman, between 25 and 30 years of age, who had been advised to undergo an operation on the supposition that a hernia was then present. No sign of its presence could be detected, and operation was performed in order to satisfy the patient's mind. A careful examination at the operation yielded no trace of the presence of a sac in the inguinal canal.

What had become of the sac? My contention is that growth had drawn it up into the abdomen. The descent of the bladder and the uterus into the pelvis (they being in the abdomen in the

child) will also play some part in the natural reduction of a hernia in the female sex during the period of growth.

(3) I have more than once operated upon the varicoceles of young men, who had, as far as can be proved, a certain history of having had a hernia when children, and at the operation no trace of the existence of a sac could be found. In these cases the hernia had only been present up to an early age; and they contrast well with the following case, in which the hernia persisted for six or seven years.

(4) In St. Thomas's Home I operated upon a man of 21 years for the radical cure of an inguinal hernia which had appeared within the last few weeks. He gave a very definite history of having had a hernia in the same situation from the age of one year until between those of seven and eight; that is to say, for a period of between six and seven years. From this age until quite recently, for a period of fourteen years, the rupture was "cured." Then a hernia of smaller dimensions, as far as its relations with the scrotum were concerned, made its appearance. At the operation the sac was thin and easily separated from the structures of the spermatic cord, showing all the evidences of its being of recent origin. It was of the acquired variety, having no connection with the tunica vaginalis. There was no trace of the former sac. Where had it disappeared to?

The above cases offer some evidence in favor of the suggestion of the disappearance and retraction of acquired hernial sacs during the period of growth. But if my suggestion of the natural cure of acquired hernial sacs by these means is true, a somewhat similar occurrence should take place when there is a congenital sac; that is to say, when the tunica vaginalis and the peritoneal cavity are in communication, so causing the late appearance of imperfect descent of the testis.

Upon this I can say but little, but I have distinctly obtained the history that a boy's testicle was in its proper place when a baby, but later it had become imperfectly descended. It cannot be assumed that this was the natural result of growth, though I can add the further evidence that at the operation the imperfectly descended testis was accompanied by a congenital hernial sac. This distinctly suggests the explanation which I have offered, of natural growth retracting into the abdomen the hernial sac, and at the same



time offers another example of the new class of acquired or secondarily imperfectly descended testes, which I introduced to you in my last lecture.<sup>1</sup>

If these views are accepted, there must be a considerable modification of our methods of treatment. There are two main lines to be followed, as indicated in the passive or predisposing, and the active, agents in the formation of hernias. In the first place, to deal with the great predisposing factor in the formation of hernias in children, we cannot prevent the occurrence of congenital malformations. As trusses are likely to be useless in this instance, if not mischievous, nothing short of operation is likely to cure a hernia which has a congenital sac. It is the hernia with the acquired sac which offers more scope for success in non-operative treatment. The factor in the production of these is the active one, namely, the increase of intra-abdominal pressure due to gastro-intestinal fermentation. Hence the importance of making the diagnosis as to which hernia is present.

Naturally, the real treatment of the case should be relegated to the physician, as that of the surgeon consists of merely preventing the "hernia" coming down by the use of a woollen or other light truss and the recumbent position if necessary. By attention to the diet the physician can do a great deal toward the cure and the prevention of hernias. With an acquired sac the treatment must first consist of attention to diet, the administration of purgatives and other intestinal cleansing agents, combined with recumbency and the use of a truss of light description. The public will have to be educated to the fact that hernias in children may require rest in bed as much as do more acute and apparent illnesses. With the above treatment a considerable number of hernias of children with acquired sacs can be cured in a natural manner by the growth of the child.

#### THE DEFORMITY OF THE INTERNAL ABDOMINAL RING CONSEQUENT UPON THE PRESENCE OF A HERNIA DURING CHILDHOOD

The next question to be considered is, How long and up to what age should this treatment be continued?

To shed light upon this point a very interesting case can be brought forward which admirably illustrates the malformation of

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<sup>1</sup> British Medical Journal, 1904.

the internal abdominal ring which results from the prolonged presence within it of a hernia during the period of growth.

R. E. F. J., an athletic and strongly made man, 21 years of age, had had a rupture from the age of 1 year until he was between 7 and 8, that is, for a period of between 6 and 7 years during the time of active growth of the body. For 14 years he remained quite cured, and came to me at the age of 21, on account of the recent reappearance of a hernia at the same place. The size and the condition of the sac confirmed the history of its origin, and have been already detailed.

The second stage of the operation, the suture of the internal abdominal ring, was not at all easy. It was this difficulty which

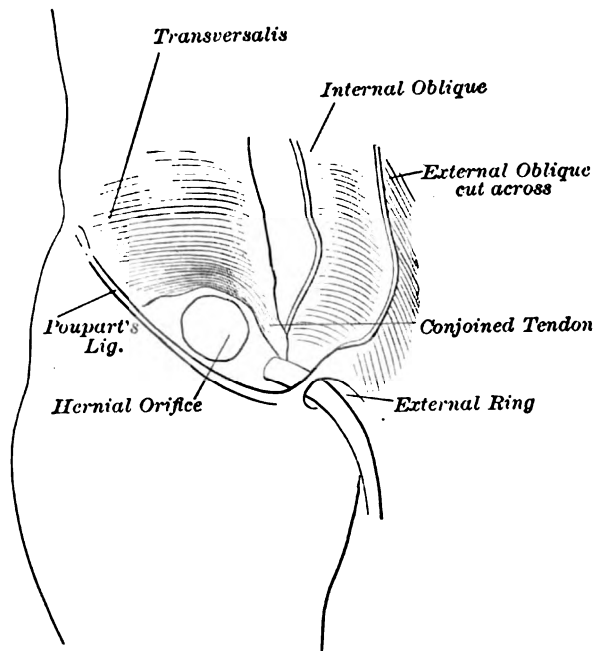


FIG. 4.—Illustrating the deformity of the internal abdominal ring, which led to the reappearance of the hernia after fourteen years of apparent cure.

attracted my attention to the condition. The shape of the hernial opening was more or less circular, whilst it should have been slit-like, allowing of valvular closure of the inguinal canal by the contraction of the abdominal muscles, which protective condition was in this instance impossible (Fig. 4). And the fact that the patient

had had 14 years of freedom from the rupture was entirely due to his naturally strong tissues rather than any safeguarding mechanism of his inguinal canal. Considerable difficulty was experienced in effecting closure of the internal ring, and a stronger silk than usual had to be used for it. The rest of the history of the case has been one of perfect success so far, and only interests the patient, his friends and relations, and myself, so that no more details will be given.

The great interest of this case lies in the interpretation of the deformity of the internal abdominal ring. The obvious suggestion is that it is dependent upon the presence of a hernia passing through it for a period of 6 to 7 years. The fact that the rupture occupied it would have prevented the ring from "growing straight." The relative growths of the internal abdominal ring and "the hole in it for the rupture" would be unequal, as the former would increase in size, *pari passu* with the growth of the body, whilst the latter would become smaller until the hernia was cured.

At the time of the final disappearance of the hernia there would be left a relatively small hole within the internal abdominal ring, more or less circular in outline, perhaps with rather hard and unyielding edges. Consequently, a distinction is made obvious between the internal abdominal ring and the aperture in it which serves for the passage of the hernia. This difference is not met with in the ordinary acquired hernias of adults or in the congenital ones of young children. Correlated with this there is a development of a few fibers of the internal oblique attached to the part of Poupart's ligament, below the limit of the usual origin of that muscle. The internal abdominal ring and the aperture of the hernia then seem to be the same.

Since this case I have operated upon a boy nearly 8 years of age, who had an inguinal hernia which had "not been properly cured since birth." At the operation he was found to have an acquired hernial sac, and there was a similar, though naturally less marked, deformity of his internal abdominal ring. On looking through my notes for cases in which difficulty had been encountered in suturing the internal abdominal ring, I found another case in which there had been a persistent hernia during the period of growth. It would, therefore, seem that this malformation is quite well marked and may, in certain degrees, be easily recognized.

The existence of such a malformation, which completely abolishes any valvular and protective action on the part of the muscles which enter into formation of the inguinal canal, and its consequences, point very plainly to the fact that there should be a recognized limit to the non-operative treatment of hernia during the period of active growth, before the deformity will have become permanent; as it is not right to continue a treatment which will lead to a permanent deformation of the internal abdominal ring and perhaps the likelihood of the formation of a hernia later in life.

There may also be mentioned from the surgeon's point of view, as later the case will be very likely to come into his hands, that there is the resulting difficulty in suturing the internal abdominal ring owing to the unyielding character of the margins of the hernial aperture; and, therefore, the performance of a satisfactory "radical cure." The contemporaneous existence of a gross pathologic process during the period of active growth and the consequent results of its action on the latter, constitutes a most important feature in the surgical diseases of children.

#### TREATMENT

For the treatment of the hernias of infants or children I would suggest the following:

(1) Treat with dieting, rest in bed if necessary, a light truss, gray powder or the like, all hernias up to the age of 4 or 5 years. The selection of this time is quite arbitrary, and the proper age-limit must be selected for each individual subject. Female children can, naturally, be treated with more forcible trusses than male.

Exceptions must be made of the following:

(a) Large and uncontrollable hernias; (b) irreducible, perhaps difficult-reducible, and incarcerated hernias; and (c) strangulated hernias.

In these it is better not to delay operative procedures. Many of the difficult-reducible hernias of children are caused by the cecum, on the right side, sliding into the sac without a complete peritoneal investment. This condition is called hernia *en glissade*.

(2) At the age of 4 years or thereabouts all hernias of children

should be submitted to operation, unless there are special circumstances. Particular mention may be made of:

(a) Those with a congenital sac. The operation is now performed at the age of election; (b) those with an imperfectly descended testis; and (c) those which have been and apparently will be persistent in character.

It may be added that this age, four or thereabouts, has been selected as the least in the way if operative interference is then required, the internal abdominal ring will grow correctly afterward, it is easier to do the operation at this age than earlier, and,

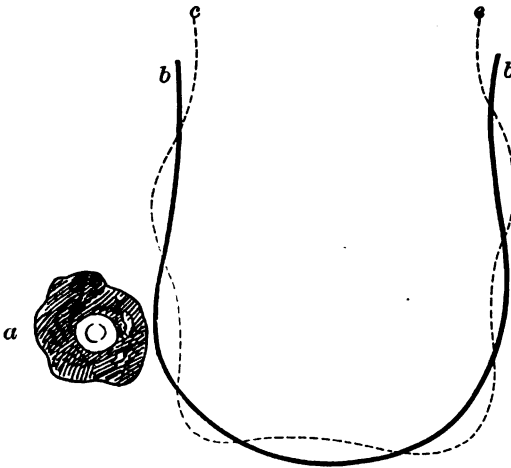


FIG. 5.—Illustrating the purse-string ligature of the sac without inflicting damage to the vessels of the spermatic cord. *a*, the spermatic cord; *b-b*, the hernial sac; *c-c*, the suture.

finally, I believe that the most radical operation, that is, with the best prognosis, can be done then which the subject's tissue will ever permit; nature, solely during the period of growth, aiding the process of cure. An eminent surgeon<sup>2</sup> has claimed that the operation of radical cure for hernia merely puts back "the hands of the clock" as regards that condition. At the age for operation which is being advocated, more can be done, as subsequent growth will aid in the cure and help to give permanence to the surgeon's work.

There are two points in the operation to which attention may be directed. The usual method of dealing with the sac is to strip

<sup>2</sup> Mr. W. Arbuthnot Lane.

it and ligature the neck, after having divided it—if a congenital one. Such a procedure is not without danger to the vas deferens and the spermatic veins, such as might lead to results which may cause cessation of growth and development in the testicle. It is therefore not always advisable to adopt the ordinary method, and to meet the difficulty I have adopted the following measures: The sac is opened longitudinally and any contents therein returned to the abdomen. A purse-string suture is carefully inserted, taking only the sac-wall, as high up as is practicable. This is then tied, occluding the opening of the sac. The hernial sac or the tunica vaginalis is left open as widely as possible. (Fig. 5.)

The question as to whether it is desirable or not to open the inguinal canal and suture the internal abdominal ring seems to depend upon the size and persistence of the hernia, and the age of the child. The larger the hernia, the longer the history of its presence, the older the child, all indicate the advisability of suturing the internal abdominal ring. It may be laid down that when there is any doubt as to the performance of this step in the operation, it had better be done. No harm, but only good, is likely to result.

#### RELATIONSHIP BETWEEN THE HERNIAS OF CHILDREN AND OF ADULTS

There must be some relation between the hernias of adults and those of children. This is a subject about which there is as yet but little known. It is quite recognized that people who have had hernias as children, sometimes have a recurrence later in life, as was so in the case which has been quoted at some length in this lecture. Adults who have had hernias when young and who have no further trouble do not come under our observation, and therefore we know far less about them. But this latter class must in reality be a fairly large one. One would expect that it would be mainly derived from those persons in whom the hernia was present only in the early months of life, was only in evidence for a short time, and had an acquired sac. In point of fact, the earlier the appearance and the shorter the duration of a rupture, the more likely it is to be cured by natural means.

As a contrast to these there are instances in which the hernia appeared late in childhood or persisted until that time. It is the persistence of the rupture which leads to the permanent deformity

of the internal abdominal ring, a result which need never occur if only the hernia is treated actively by operation at an early age. And on this account it seems advisable that ruptures in children, that is, during the period of active growth, and before heavy muscular strains are indulged in, should not be left too long. For generations there has been a cry that surgery should aid nature. During childhood is the only time at which the surgeon has nature to help him in his attempts to cure hernias. Hence, it seems that this will be the time of life when the prognosis will be the best, and should be the age of election for the success of an operation.

Throughout I would urge the advisability of the diagnosis being made between the congenital and the acquired sacs of hernias. It seems more than doubtful if the former, congenital sacs, can ever be cured by any measures short of division and ligature of the sac. Whilst, as has been pointed out, those with the acquired sacs have a very fair chance of being permanently cured by the purely natural means of healthy growth, and should only be interfered with operatively for their persistence, their size, uncontrollability, their developing acute symptoms, or for any special reasons, such as the presence of an imperfectly descended testis, etc.

To return to those hernias which have congenital sacs, at present there is little evidence that the canal of the neck of the sac ever becomes obliterated by a natural process which has been delayed, such as that which normally occurs before birth. Personally, I firmly believe that such a belated natural process does occur, and for evidence of it I would instance the cure of the hydroceles of babies which originally have patent communications with the perineum. Of course, this is no direct proof, but it affords some basis upon which one can rest an act of philosophic faith. If this communication persists up to the "age of election," 4 to 5 years, the case of hydrocele had better be operated on just as if it were a hernia. Nor is it right to use a truss which exerts sufficient pressure on the neck of the sac to lead to its closure by means of the formation of peritoneal adhesions, on account of the fact that the self-same pressure will act also on the nutrient vessels of the developing testis, and so cause such pathologic changes as will hinder or entirely prevent the future perfection of that organ.

There is yet another problem to which attention must be directed. Can the abdominal distention of a child, if it persists,

exert any deleterious action upon the hernial regions during their growth, short of the actual formation of a hernia, which can predispose to such a development in the adult? Long continued abdominal distention, during the period of growth, may bring about a lax and weakly condition of the region of the hernial rings. And I cannot help thinking that the seeds of future hernial formation are sown during infancy and childhood far more often than we suspect. We are all familiar with the large, loose, lax inguinal rings of adults, so frequently found, in which no definite hernias are felt. How is it that these rings come to be so large? Is it because they are congenitally so? or is it that they are the result of persistent distention of the belly during childhood? There seems no doubt that we must favor the latter hypothesis, though the former may be true in some rare instances. These large rings have a counterpart in the divarication of the recti, so often seen in children with distended abdomens. Persistent abdominal distention in children will lead to the abolition of the protective valvular muscular mechanism of the inguinal canal, which condition may remain in adults and lead to the development of a hernia.

It is to be hoped that the subject of the relationship which exists between persistent abdominal distention or the actual occurrence of hernia during infancy and childhood, and the hernias of adults has been clearly put before you, so that the question may receive more attention in the future than it has in the past. And let us hope that medicine and surgery in childhood will do much to abolish these complaints in the adult. It is curious, or better, unusual, that in a lecture on surgery, medicine should be so strongly advocated. But anyone who attends our out-patient department will not be able to resist the conclusion that distention of the intestine by the gases formed in fermentation is the most important factor in the actual production of a hernia in a child and, let us suggest, possibly also in the adult. A similar relation may, and probably does exist between the hydrocele of a child and the hernia of the adult in a lesser degree.

To sum up, this lecture has been utilized to urge upon you the possibility, if not the fact, that if only more attention is paid to the diet and the persistence of abdominal distention of children, to the advisability, or not, of operative interference for all hernias in children which are persistent or of which the subjects are above



the age of five years, to the diagnosis between the acquired and congenital hernial sac, and to active treatment adopted during childhood, far fewer adults will be handicapped by that common disadvantage, a hernia.

## UMBILICAL AND VENTRAL HERNIAS

Finally, before this lecture is concluded, reference must be made to the umbilical and ventral hernias of children, which illustrate admirably, in a form which will be readily accepted, many of the points, problems, and principles which I have advocated with regard to inguinal hernias.

To begin with, the fact that these hernias—umbilical and ventral—are correlated casually with persistent distention of the abdomen, will be more readily agreed to than is the case of those in the inguinal region. Also, it is well recognized, that if the distention is relieved and no visceral protrusions allowed to occur, these hernias may be cured. And I think that people will be more ready to accept my suggestion, that the growth of the abdomen retracts the peritoneal sac of the hernia within the abdomen, and so “cures” the rupture in a natural way. The views put forward and derived from a study of inguinal hernias, in point of fact, seem more likely to meet with acceptance in their application to the umbilical and ventral protrusions. In the latter situation the full force of the evil of the persistence of the hernia will be appreciated, and also the necessity for operation before permanent deformity has been inflicted on the ring by the rupture. Likewise, the natural cure and the restoration of the umbilical ring to its proper condition will meet with ready acceptance.

It is merely necessary to point out that these hernias exemplify all the points put forward in a previous section of the lecture. But it is advisable to point out one difference which umbilical hernias exhibit. These ruptures are merely local manifestations of the effects of abdominal distention; the divarication of the recti muscles is another and accompanies them without hernia, corresponding, when alone, to the large inguinal rings, which, I have suggested, arise from abdominal distention and divarication in these situations. As a consequence, when operating for umbilical hernias, it is advisable to continue the suturing well above and below the navel, so as to do more than merely close the local manifestation.

## INJURIES OF THE PROSTATE GLAND

BY G. FRANK LYDSTON, M.D.

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TRAUMATISM of the prostate, save from surgical operations and manipulations, is exceptional. Contusions and lacerations due to direct force from falls or blows are especially rare on account of the situation of the organ, protected as it is by the pubic and ischial rami and ischial tuberosities. The force of falls and blows upon the buttocks is usually broken by these osseous structures. Blows upon the perineum are not likely to injure the prostate because of the distance of the organ from the impinging body and the elasticity of the musculo-cellular cushion constituted by the tissues of the ano-perineal region and ischio-rectal fossa. Instances have been known of the membranous urethra having been torn completely across at the apex of the prostate, yet the prostate has escaped injury. Crushing injuries involving the prostate are almost necessarily fatal, excepting when the prostate is injured indirectly through the medium of fractured pelvic bones that are driven into the organ.

In extensive crushing injuries the traumatism of the prostate is comparatively a minor consideration. Incised, punctured, and lacerated wounds of the prostate from accidental injury are occasionally seen. Sharp bodies may be driven into the perineum, the patient perhaps falling astride them. Most of the accidental injuries are due to a fall upon some pointed object. Dugas cites a case in which a branch of a tree was driven into the perineum and the prostate wounded. Velpeau reported a similar case in which a wooden stake was driven into the perineum. Brittle substances introduced into the rectum have been known to penetrate the prostate. Obviously such penetration can occur with great facility. Injury to the prostate by fire-arms is necessarily very rare. Ricord, however, reported a case in which a musket-ball penetrated the false pelvis, passed downward along the iliac fossa, entered the true

pelvis, and penetrated the prostate. It was detected by digital examination of the rectum and extracted by perineal section.

Wounds of the prostate inflicted in surgical operations are frequent. It is necessarily wounded in all perineal lithotomies, with the exception of the simple median operation. It is often wounded in perineal urethrotomy, and invariably wounded in the proper performance of perineal puncture for vesical drainage. Operative wounds are not dangerous *per se*, unless the incision or laceration, as in the case of extraction of too large a stone, extends beyond the bounds of the fascial investments of the prostate, thus involving the pelvic cellular tissue or peritoneum. The prostate is often injured from its urethral aspect in the passage of the catheter or sound, or in the performance of that extremely hazardous operation, internal prostatotomy. These forms of prostatic trauma are exceedingly dangerous because of the exposure of the injured tissue to sepsis and the necessarily imperfect drainage. An additional element of danger is uncontrollable hemorrhage. These factors are done away with in perineal or suprapubic operative wounds of the prostate. Another danger is the formation of a false urinary passage. False passages traversing the prostate and beginning in the prostatic urethra or at some point in the urethral walls at a greater or less distance anterior to the apex of the organ are frequently seen. Instances have been known in which a catheter or sound has been passed through the urethral walls at some point in front of the bulbo-membranous region, traversing the tissues outside of the urethra and penetrating one or the other lobe of the prostate, thus finally reaching the bladder by a round-about and most dangerous route.

The revival of the Bottini operation afforded another variety of trauma of the prostate. That the advantages of the operation do not compensate for its dangers experience has shown.

*Results of Prostatic Wounds.*—As already suggested, wounds from the interior are not likely to be followed by serious results, provided the injury be limited to the prostate itself. Lacerations and contusions are more dangerous than smooth incisions, save with respect to hemorrhage, which is obviously greater in clean incised wounds, unless such wounds be external and open. In considering the question of hemorrhage from operative or accidental wounds of the prostate, it is well to remember that the region of the prostate

is very vascular, and rather difficult of access for the application of methods of hemostasis. Retention of urine from congestive or inflammatory occlusion of the urethra, or from complete or partial obliteration as a result of the traumatism, is likely to be an important consideration in prostatic injuries. Pyogenic infection and abscess, possibly followed by urinary fistula, and septic cellulitis are serious results that are likely to occur in extensive injuries, especially when drainage is imperfect. The septic cellulitis may be limited to the ano-perineal region and ischio-rectal fossa, or may extend over a large area of the subcutaneous and intermuscular planes of cellular tissue. If the wound extends beyond the bounds of the prostate, septic pelvis cellulitis or general peritonitis may develop, these being intrinsically fatal. Constitutional manifestations of septic or pathogenic intoxication may supervene. It will be observed that, in a general way, the conditions produced by and dangers of prostatic injuries are essentially the same as in traumatism of the urethra and bladder.

*Symptomatology.*—There is nothing characteristic in the symptomatology of prostatic injuries. In general, they are similar to those of deep urethral traumatisms. The principal symptom is urethrorrhagia, provided the wound communicates with the urethra, and hematuria. If an open wound of the prostate exists and the urethra be injured, the hemorrhage occurs at the site of the injury and also at the meatus. Retention of urine has already been alluded to, and is an important factor in the symptomatology of prostatic traumatism. If extravasation of blood into the surrounding tissues be extensive, a hematoma may result that may be felt by way of the rectum, around which viscus it may burrow for a considerable distance. The local and constitutional symptoms that speedily follow serious injuries of the prostate are similar to those following urethral injuries producing urinary infiltration, cellulitis, or abscess.

*Treatment.*—External operative wounds do not demand special consideration. In both internal and external wounds that are not extensive, and in which a catheter can readily be passed, a full-sized soft instrument should be introduced into the bladder and retained from three days to a week or more. Great care is necessary to maintain urethral asepsis. If hemorrhage be excessive or urinary extravasation exists, or there is reason to believe that the wound of the prostate is serious, and in any case in which the

catheter does not pass readily, a free perineal section should be made and the bladder drained by a large tube. When the perineum is extensively disorganized by injury, and it is difficult to find the proximal end of the urethra, suprapubic cystotomy, retrograde exploration, and perineal incision should be combined. Suprapuboperineal drainage should be instituted in such cases. This is much safer than prolonged and necessarily haphazard search for the normal channel *via* the perineum. Infiltration of urine demands free incision in any and all situations in which intumescence of the tissues is suggestive of extravasated urine. The incisions can hardly be too free or too numerous with due regard to anatomic dangers. The same principles should govern the management of urinary abscess and cellulitis. The early and free use of the knife in septic cases is the only hope of saving life. The tendency to asthenia, incidental to the profoundly depressing influence upon the sympathetic nervous system produced by injuries of this region, and the great danger of toxemia, constitute a direct and positive indication for free and liberal supportive measures, dietetic and stimulant.

# ENLARGEMENTS OF THE TESTIS AND EPIDIDYMIS

A CLINICAL LECTURE DELIVERED AT THE COLLEGE OF PHYSICIANS AND SURGEONS,  
CHICAGO

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GENTLEMEN: I desire to show you to-day five cases, side by side, which should prove of great interest in considering the differential diagnosis and treatment of enlargement of the testis and epididymis. Before giving a detailed description of the cases, however, let me place upon the blackboard a short synopsis of the differential diagnosis of enlargements of the testis and epididymis.

We may divide these enlargements, as in this table, into acute and chronic. We shall find from time to time, however, cases which cannot be strictly grouped under one or the other divisions. For example, about a year ago, I reported a case of tuberculosis of the epididymis and testis, which undoubtedly appeared within a few weeks after the onset of a gonorrheal epididymitis. There are many cases of this kind, in which a disease, like tuberculosis, which belongs to the chronic types, gives rise to enlargement of the epididymis within two to three weeks, behaving under these circumstances like a disease of the acute type. With these exceptions, this table will be found quite useful:

## ACUTE.

(1) *Gonorrhea* almost invariably involves the epididymis, seldom the body of the testis, or orchis proper.

## CHRONIC.

(1) *Tuberculosis* is the most frequent cause of chronic enlargement, and, as a rule, first involves the epididymis, especially the tail of this portion of the organ, and later involves the body of the testis proper. It gives rise to a peculiar, nodular, very firm condition of the epididymis, feeling like a series of beads, and often extending in a similar manner up the vas deferens.

(2) *Trauma* almost always involves the body of the testis proper, and but seldom the epididymis.

(2) *Syphilis* in the majority of cases involves the body of the testis proper, and but rarely the epididymis. There are, however, exceptions to this, as in the case described below, in which tertiary syphilis involved the epididymis, as well as the body of the testis.

(3) *Epidemic parotitis* or *mumps*, as a rule, affects only the orchis, or body of the testis proper.

(3) *Tumors* or *neoplasms* of the testis may be either benign or malignant; the benign belong to the class of adenomas, or chondromas, the malignant most frequently to the class of sarcomas.

(4) *Cystitis* of non-gonorrheal origin is a frequent secondary complication, as is also inflammatory enlargement of the epididymis.

CASE I.—*Syphilitic Orchitis*.—A negro, 30 years of age, three years ago, had a hard chancre, which was followed by mucous patches in the mouth. He states that about three months ago he noticed a slightly painful enlargement of both testicles. This has remained stationary. He has not taken any medicine for the past year. The examination to-day shows that the epididymis on the right side is greatly enlarged, not tender, quite firm to the touch, and that the enlargement extends into the spermatic cord, almost as far as the external abdominal ring. The testicle of the same side is moderately enlarged. On the left side the enlargement of the epididymis is not as great as upon the opposite side, and here the testicle seems to be chiefly involved. It is the size of the adult fist, very firm, not at all tender, and in conjunction with moderate enlargement of the epididymis of this side forms quite a formidable mass, which can be readily seen when the patient stands at a distance, as he does now. On this side the spermatic cord is only slightly thickened. Examination of the seminal vesicles and the prostate through the rectum shows that they are not enlarged. In this case we have a combination of a syphilitic epididymitis and orchitis. The epididymis is chiefly involved upon the right side and the orchis, or body of the testis proper, upon the left side.

This case illustrates the tendency of syphilis to involve chiefly the body of the testicle, but, at the same time, it illustrates the fact

that a syphilitic epididymitis, although rare, may occur; but if it does, it is usually in conjunction with enlargement of the orchis or body of the testis. These syphilitic enlargements of the testicle are frequently known as sarcocoeles. They occur almost invariably in the tertiary stage and may be classed pathologically under the head of the gummatous form of syphilis. I can recall a patient whom I saw about three years ago, a man who entered the hospital on account of enlargement of the glands of the neck. In making a thorough examination of him, it was observed that the body of the testicle of the right side was greatly enlarged, almost the size of two adult fists and not tender. The epididymis was normal, and, reasoning from the table which I have just given above, that the enlargement of the orchis is a frequent manifestation of tertiary syphilis, we diagnosed the case as one of combined syphilitic enlargement of the glands of the neck and of the orchis. He responded very quickly, as has the patient whom I show you to-day, to the use of large doses of potassium iodid, and the enlargement of the cervical glands and of the testis rapidly disappeared.

CASE II.—*Tuberculosis of the Epididymis; Secondary Involvement of the Seminal Vesicles, the Prostate, and the Vas Deferens.*—The second patient is 35 years of age. His father died of some pulmonary disorder following pneumonia, in all probability of a tubercular nature. His mother and two sisters are healthy. About three months ago he noticed a moderate amount of pain in the right side of the scrotum, and a gradual increase in the size of the right testicle. Upon admission yesterday, we noticed that the epididymis was greatly enlarged and moderately tender to the touch. It had all the characteristics of a typical tuberculous enlargement of the epididymis, consisting of a series of nodules or beads, and very firm. This enlargement of the epididymis was continuous with a moderate amount of thickening of the spermatic cord of the same side. In the latter a number of nodules could be felt as high up as the cord could be palpated to the external abdominal ring. Examination through the rectum, when the patient is placed in the knee-chest position, shows that the right lobe of the prostate contains a nodule that is quite firm and apparently the size of a hazel-nut. By inserting the finger still higher into the rectum, the seminal vesicles of the same side can be palpated as a hard, nodular mass.



Considering the diagnosis of this case, one can readily exclude all of the more acute forms of enlargement of the epididymis, such as those due to gonorrhea, and consider only the more chronic forms. The absence of a history of chancre and the strong family history, the father having died of what was probably acute pneumonic phthisis, renders it likely that the condition is tuberculous. Its chronic course, the peculiar nodulated condition of the epididymis, the presence of the above-mentioned nodules in the spermatic cord, and the secondary involvement of the prostatic lobe of the same side and of the seminal vesicle, confirm this view. As far as external examination can detect, there is no involvement of the testicle or orchis proper. I have called attention in the above table to this peculiarity of tuberculosis, which almost invariably, in its early stages, involves the epididymis, but seldom the body of the testis.

The operation which I am about to undertake involves a thorough removal of the tuberculous foci. The testicle being exposed, and having been removed by ligating all of the structures of the spermatic cord as close to the external abdominal ring as possible, I shall ask one of the assistants to open the organ in order to estimate the extent of the lesion. A section through the middle of the testicle and epididymis demonstrates that our diagnosis of tuberculosis is confirmed. The entire epididymis is converted into a soft, cheesy mass, and at the hilum of the testicle one can observe several cheesy foci, but the remainder of the body of the testicle, so far as macroscopic appearances reveal, is free. Sections of the spermatic cord show that the little nodules which we felt through the intact skin were also tuberculous foci. The specimen illustrates the tendency of tuberculosis to involve chiefly the epididymis, the disease being apparently primary here, and then extending upward along the spermatic cord and ultimately involving the structures at the base of the bladder.

The ideal method of dealing with these cases would be to open the inguinal canal and to remove as much of the vas deferens as one can reach through this incision, and then to proceed, by means of a perineal incision (preferably the Zuckerkandl half-moon-shaped incision), to remove not only the affected lobe of the prostate and the seminal vesicle, but also as much of the spermatic cord as one can reach through this incision. As I stated before, this is an

ideal method, but practically it is very difficult to get all of the vas deferens, and the result is that many of these patients for months have sinuses in the inguinal region leading to the stump of the cord. In many, with improvement in the general health, the remainder of the disease heals. The right lobe of the prostate, which I have just removed, shows a cheesy nodule that is not broken down, and is about the size of a hazel-nut. The seminal vesicle of the same side also shows typical tuberculous changes.

The prognosis of this form of genito-urinary tuberculosis is not as favorable as one might expect with such radical removal. Not infrequently the disease is present at the same time in the epididymis of the opposite side, or, as in a patient I operated upon recently, it would seem as if an independent primary focus occurred in the kidneys. A tubercular pyelonephritis may, however, occur secondarily through an ascending infection from the epididymis by way of the bladder and ureter.

I shall utilize this occasion to call attention to that class of cases, which I have referred to briefly above, in which a gonorrheal epididymitis passes almost imperceptibly into a tuberculosis. I had occasion to report an interesting example of this form about a year ago. The patient was a young man, 24 years of age, whom I saw in consultation on account of enlargement of the epididymis which had begun rather acutely, and who had a very abundant discharge from the urethra, which contained typical gonococci. I advised antigonorrheal treatment, believing it to be a gonorrheal epididymitis. Soon afterward pus was discharged through the scrotum, and this first led us to consider the possibility of a mixed infection. An examination of the urine revealed not only gonococci, but a large number of tubercle bacilli. Examination through the rectum showed characteristic enlargements of the prostate and seminal vesicles. In spite of thorough removal of all of these structures, the patient died about a year afterward of uremia, the autopsy showing tuberculosis of the kidney. About six months before his death I removed one of the kidneys (the left one) and all of the ureter as far down as the base of the bladder. The urine from the right kidney at this time revealed no tubercle bacilli, but the urine from the left one, the ureter of which I catheterized, showed not only tubercle bacilli, but also gonococci. These observations were confirmed by specimens taken from the removed

kidney. This was evidently one of those varieties of gonorrhea in which the tuberculosis is a fatal complication.

CASE III.—*Epidemic Parotitis with Metastatic Orchitis*.—The third patient is a boy, 14 years of age, who had an attack of mumps one week ago. For the past two days he has complained of severe pain in the left testis and fever; at the present time his temperature is 103° F., and his pulse 110. We find upon examination that the body of the left testis is about the size of the adult fist and extremely tender, and that the pain is considerably relieved by elevating the scrotum. There is no enlargement or tenderness of the epididymis or the vas deferens, whence we are enabled to differentiate the disorder from an acute inflammatory condition due to gonorrhea. There is no history of injury, so that we must conclude that we are dealing with a metastatic orchitis, secondary to mumps.

If you will refer again to the table which I have just given you, you will notice that this variety of inflammation belongs to the acute type, and that it is not an infrequent sequel of mumps in boys. A similar condition occurs in girls as an acute inflammation of the ovary (ovaritis), which must be thought of when a girl complains of extremely severe pain in the lower portion of the abdomen in the region of the ovaries within ten days or two weeks after an attack of mumps. One can easily differentiate this variety of enlargement of the testis from the acute traumatic enlargement by the absence of a history of injury; from the acute gonorrheal enlargement by the absence of involvement of the epididymis and cord; from the more chronic type, such as syphilis, by the more acute inflammatory symptoms which are present in this case. There is no direct anatomic connection between the parotid or submaxillary glands and the body of the testis and the ovary. The only way in which one can explain such a metastatic inflammation is to assume that mumps is an infectious disease similar to influenza, scarlatina, etc., in which the cause circulates in the blood and seems to settle by preference in these organs. When the patient first complained of the pain in his testis, a distinct murmur, systolic and most marked at the apex, was quite audible; this had gradually become fainter. The explanation of the murmur is undoubtedly to be found in a temporary metastasis or infection of the heart-valves.

CASE IV.—*Gonorrheal Epididymitis and Acute Gonorrheal Hydrocele.*—The fourth patient is a young man, 18 years of age, who entered the hospital one week ago, with the following history: About three weeks ago he began to have all the symptoms of acute urethritis. The examination at that time revealed gonococci in the purulent discharge. He was given rather vigorous treatment with strong injections of silver preparations, and soon after was obliged to urinate every few minutes, and he began to have pain, severe and lancinating in character, in the left side of the scrotum. As soon as this pain began, the discharge lessened greatly. The explanation of these changes is the following: Ordinarily, during an acute attack of gonorrhea, the inflammation is limited to the anterior portion of the urethra, that is, that portion in front of the triangular ligament, and in only more severe cases does it involve both the anterior and posterior portions of the urethra in the early stages. The use of injections under considerable pressure forced the infectious pus into the posterior portion of the urethra and bladder, and caused a urethrocystitis. At the same time, the gonococci migrated along the seminal ducts, which open into the posterior portion of the urethra, and then followed the vas deferens into the epididymis. It is a matter of common experience that the moment a patient with an acute gonorrheal urethritis begins to have an epididymitis the discharge from the external meatus ceases, or becomes very slight. We find upon examination of this patient that his temperature is 102° F. He seems to be suffering great pain; the left side of the scrotum is very prominent, and the epididymis rides like a cap upon the testis or orchis proper. It is very firm, extremely tender, and many times larger than normally. At the same time, you will note that there seems to be an enlargement apparently attached to the body of the testis, but careful palpation shows it to be separated from the latter, and to be due to an acute accumulation of fluid in the tunica vaginalis; in other words, we have, in addition to a gonorrheal epididymitis, an inflammation of the vas deferens, as high up as one can palpate it, and an acute gonorrheal hydrocele, which will be greatly relieved by the puncture which I shall now undertake. The fluid which escapes is slightly turbid. The pain of the epididymitis will be treated by suppositories containing 1 grain (0.06 gram) of extract of opium, and  $\frac{1}{2}$  grain (0.03 gram) of extract of hyoscy-

mus, given every four hours, as long as the pain continues. This usually gives relief within 24 hours.

We shall advise that he remain in bed and that the scrotum be supported by a towel, so that the testicles lie almost upon the abdomen. At the same time we shall use for the next three days something which I have found to be very efficacious in reducing the acute inflammatory conditions, and that is painting the entire affected side of the scrotum once daily, for not more than three days, with pure guaiacol, or if this seems too severe, the application of a 50 per cent. guaiacol ointment. We shall absolutely forbid the patient to walk about, and shall move the bowels by means of a mild laxative, such as cascara, being careful to avoid any of the saline preparations, on account of their irritant action; and we shall give internally 5 grains (0.30 gram) each of salol and urotropin in the form of a powder, every four hours. Local treatment of the urethra is to be discontinued until every trace of the inflammatory condition of the epididymis has disappeared.

CASE V.—*Tumor of the Testis (Adeno-Cystoma)*.—The last patient whom I shall show you is a man, a bricklayer by occupation, 30 years of age, who has had an enlargement of the right side of the scrotum for the past three months. He was sent here by a physician who stated that he had made a puncture of the scrotum, thinking that the case was one of hydrocele, and obtained only a very small quantity of fluid. The examination will show you that the enlargement does not involve the epididymis nor the spermatic cord, but that it is located anatomically in the body of the testis. The latter is about the size of two adult fists, not at all tender, does not transmit light, as would a hydrocele, and has been slowly increasing in size during the past three months. The operation which I shall perform upon this patient will consist of a castration. An incision is made extending from about the pubes to the middle of the scrotum, and the tumor exposed. Through this incision the mass can be readily delivered, and after having been freed from its attachments to the interior of the scrotum we pass a strong catgut ligature through the structures of the spermatic cord, close to the external abdominal ring. The wound is then sutured with silk-worm gut, after ligation of bleeding points.

An examination of this tumor shows that, in addition to a mild degree of hydrocele, which very frequently accompanies malignant

and non-malignant growths of the testis, there is a form of tumor which has been described as a cystadenoma of the testis, in which there is a new growth of the seminiferous tubules, which multiply so rapidly that cysts are formed.<sup>1</sup>

As you will note, the new growth involves only the body of the testis, as such tumors of the testicle usually do, leaving the epididymis and vas deferens free. It is of the benign type of new growth. The other principal members of this class are the so-called mixed tumors of the testis, which consist of many of the primitive connective-tissue elements, and may be termed pathologically fibromyxolipochondromas. The malignant forms of tumor of the testis are most frequently sarcomas.

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<sup>1</sup> This diagnosis was later confirmed by microscopic examination.

## ACUTE PURULENT GENERALIZED MENINGITIS.

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WHAT we have to say concerns meningitis originating in the ear. From fifteen to twenty persons die each week in Paris from a form of meningitis that the city statistical report classifies as "simple." Now this term means only that these cases were not tubercular; but the latter form does not always attain a similar figure. Consequently, simple meningitis is not at all a rarity, and deserves our fullest attention.

This general term "simple" meningitis comprises different varieties of non-tubercular meningeal infection: cerebrospinal meningitis, serous meningitis, and especially acute secondary suppurated meningitis, the latter forming the chief element of the group. "Secondary" has here nothing to do with syphilis; the term means consecutive to primary neighboring suppuration, which may be either endocranial or exocranial. They are rarely endocranial, as, for instance, when a cerebral abscess opens into a ventricle. Usually they are exocranial.

Around the ears, as about the nose, the bones have formed cavities; in the first instance the mastoid cells, in the second the sinuses of the frontal, ethmoid, and sphenoid bones. They are supposed to contain only air, but sometimes contain pus, which, in order to reach the meninges, has hardly any farther to go than have the streptococci to get from a pus-tube to the peritoneum. The analogy between the two cases is great, with the main difference that peritonitis is usually engendered by the uterus, while meningitis has a marked tendency to start from the ear.

The study of otogenous meningitis is therefore a matter of general surgery.

Up to the end of the last century meningitis was the only complication of otitis that was still universally admitted to be incurable. Körner sought through the literature for a case of true recovery, without being able to find one.

The surgeons confessed that if they happened to take up the knife in the presence of an ear case with meningeal symptoms, it was because, in their inability to be certain of their diagnosis, they wished to give the patient the benefit of the possibility of an error on their part. This modesty saved a number of lives.

But to-day this cause of uncertainty no longer exists, since lumbar puncture enables us to be sure of our diagnosis. Does this mean that surgeons are to withhold their hands in such cases in the future? Fortunately not.

A certain number of cases of acute generalized purulent meningitis, tending fatally, have been cured by lucky operators, so that to-day, in the presence of a case of oto-meningitis, the surgeon must say that so long as the patient is not moribund he may by an appropriate operation effect complete recovery, whereas non-intervention can only mean death to the patient.

MacEwen is the first who opened, drained, and cured a case of meningeal suppuration. To speak truly, the cases cured and published are not yet very numerous; eliminating those of serous meningitis, which do not concern us, we cannot find more than six or seven (Gradenigo 3, Labbé 1, Braunstein 1, Wilson 1, and Fischer 1). For this reason we are fortunate in being able to make an original contribution to this question, which may soon reach a foremost rank in surgery, by publishing two personal cases of surgical cure of generalized, purulent, otogenous meningitis.

CASE I.—A girl of 19 years entered a medical ward of the hospital toward the end of 1902, with fatigue, headache, and disturbed digestion which did not admit of an exact diagnosis, until during the night following January 20 acute symptoms occurred that left no doubt about a diagnosis of meningitis; and since her left ear had been running for a year, the patient was at once passed over to our special wards. On January 22 all the signs of acute meningitis were present: Kernig's sign, stiff neck, headache, emesis, high temperature, etc.; lumbar puncture gave under great pressure a liquid containing 58 per cent. of lymphocytes, and 40 per cent. of polynuclear cells. We at once emptied the left ear as well as the cranial bones around it, but without opening the dura mater, which, although fungous, showed no fistula.

The next morning the temperature was normal; two days later Kernig's sign had disappeared. On January 28 the liquid ex-



tracted by lumbar puncture contained 99 per cent. of lymphocytes and 1 per cent. of polynuclear cells.

A month later, February 20, the patient left the hospital to resume her occupations. The mastoid wound was not entirely covered with epidermis before September, on account of the gradual and spontaneous elimination of a sequestrum of the labyrinth. Since that time the patient has enjoyed perfect health.

CASE II.—A girl of 18 years, whose right ear had run since she was seven, in spite of endless boric injections. In November, 1903, she was seized with acute mastoid symptoms after having caught cold, and entered our special wards, where, on December 3, we performed the usual petromastoid emptying operation, during the course of which we noted that the dura mater was intact; there was, furthermore, no clinical sign of a cerebral nature. The operative sequels were normal, when, during the afternoon of December 15, she was seized with intense headache and constant vomiting, her temperature rising to 102.6° F. The next morning the spinal fluid was not clear, almost purulent, with intense polynucleosis. We decided at once to open and drain the meninges, since, as regards the diseased ear, everything had already been done.

The dura mater was freely exposed and opened, and a number of punctures made in the temporal lobe, with no result. During this process we discovered caries of the labyrinth which had been, as is usual, the road followed between the otitis and the meningitis.

By the following day there was improvement. On December 17 the spinal fluid was scarcely cloudy and contained fewer polynuclear cells, though still many leukocytes; on December 19 it was transparent and no longer gave a deposit on centrifugation. On December 23 the patient went out of doors. Still, there remained marked inequality of the pupils, and crises of headache with vomiting caused us some uneasiness. However, about the middle of January all abnormal symptoms had disappeared.

We had to let the labyrinth sequestrum eliminate itself, so that the wound was not entirely healed before May; but since February her meningitis could be looked on as definitely cured.

There is every probability that in view of the intensity of the symptoms in these two cases the patients would have died had we not operated. If their illness had occurred five years earlier we should have had no more than two necropsies to report; whereas,

at the present time these two young women have resumed their professions without thinking of the danger they ran, very grave for them, but instructive for us. This progress is due to otology.

Acute purulent meningitis was up to our time the only complication of suppurative otitis that we surgeons felt ourselves powerless to overcome. In the future it will be our duty to treat it, as fortunate precedents force us to do so. At the present time, then, there are no more otogenous cerebral complications that are beyond our reach.

But in order that the surgical treatment of purulent meningitis may in the future win laurels equal to those of the surgical treatment of brain abscess or of thrombophlebitis of the sinuses, it will be necessary that in such a difficult question each operator should not be abandoned to his personal initiative alone. Consequently, relying on the cases published and on our own, we think that we can lay down rules for the surgical treatment of otogenous purulent meningitis. No doubt that the future, rich in un hoped-for recoveries, will modify them; we are only writing for the present day.

We shall extend as far as possible the indications for the surgical treatment, not being willing to accept Schulze's restrictions, who fears lest surgery lose prestige through too frequent failure.

We have to deal with a disorder that is necessarily fatal if abandoned to itself, and an operation which, well performed, presents no intrinsic danger. The conclusion is, as Brieger has so aptly put it, that unless the patient is moribund there is no contra-indications that should stay our hands. Naturally, the earlier we operate the greater will be our chances of success; but let us keep clear of the pitfall of sacrificing a patient's life for the sake of our record! Leutert's simple conception of the situation seems to us the best: any spinal liquid that is not transparent, even if it contains no germs, ought to make us diagnose clinically meningeal infection and oblige us to intervene.

**RULE I. EMPTY THE OS PETROSUM FREELY AND LAY BARE THE DURA MATER, WITHOUT OPENING IT.**—Two things must be done from the start: (A) *Open and drain the middle ear.* It is possible that paracentesis alone has seemed sufficient in a given case to check an oncoming meningitis; it is even possible that puncture of the tympanum often succeeds, particularly with children, in

putting a stop to meningeal infection that is still localized. May not many of the so-called symptoms of meningism that are cured by prompt incision of the drum be merely manifestations of partial suppuration of the subarachnoid space, species of auricular petri-meningitis? This is possible. But with a question as new as the one we are now treating we cannot take such hypotheses into consideration, as we must base our opinions altogether on facts beyond dispute.

Paracentesis tympani is not sufficient; we must clear out the entire middle ear, make a radical cure of the otorrhea. In chronic cases no one contests this; but in acute cases the objection will probably be raised that simple antrotomy is enough, and that it is not wise systematically to destroy the hearing on the diseased side. We can reply that in the first place this is a small sacrifice in exchange for the life that the patient runs the risk of losing; and, again, that the complete clearing out of the ear has two advantages over paracentesis: first, it cleans out and drains in the best possible manner the entire extent of the pus focus in the ear; and second, that it clearly exposes the roof of the middle ear as well as the external wall of the labyrinth, the regions through which the pus usually burrows from the ear into the meninges, and consequently that it does all that the circumstances of such cases call for.

In a word, when we are called to a case of acute meningitis that can be clearly attributed to ear suppuration, our first duty, as soon as our diagnosis has been made by examination and lumbar puncture, is to open completely the primary diseased focus in order to drain it freely and even do away with it altogether if possible. Nothing but total scraping out of the petro-mastoid bones fills this indication.

But this, according to our ideas, is not yet sufficient; a second indication, complementary of the first, arises at the same time.

(B) *Exploratory craniotomy.* Make an opening of moderate dimensions in the skull, large enough to explore thoroughly the surface of the dura mater.

To avoid as far as possible wounding the facial nerve, craniotomy should be performed at the roof of the antrum and bearing toward the exterior. In some cases pre-existing bony lesions will indicate a natural path for the instrument; but, as a general thing, since the meningitis is consecutive to lesions of the labyrinth, no

patch of osteitis will be found as a guide. The point of attack indicated seems to be the best; it enters the skull at the lowest point and does not necessitate any enlargement of the cutaneous incision.

This systematic craniotomy has two advantages: First, it enables us to examine the endocranium and to evacuate possible extradural purulent collections whose existence may have been masked by the importance of the meningeal symptoms; second, it effects marked decompression of the brain, which it frees from its fetters, as it were. The result is not only real relief for the patient, but actual protection for the brain, whose elements thus escape the danger of too great or too prolonged pressure from an excess of cerebrospinal liquid in a closed cavity.

Therefore, as well for a means of diagnosis as of treatment, systematic craniotomy ought to be the complement of the opening up of the ear cavities.

But all immediate intervention should stop at this point, for the time being, at any rate. This first surgical advance should halt at the dura mater, and not enter it on that day, however intense the meningitis may seem,—no matter whether the dura mater be healthy or fungous. Still, an exception must be made for cases (not rare when there is brain abscess, but quite exceptional in meningitis) in which a dura mater fistula shows pus coming from the brain and invites the surgeon to proceed farther without delay.

The reasons with which we justify this view are, to begin with, that the slightest incision of the dura is a far more serious act in its possible results than an extensive craniotomy; again, that cases of operative cure of true purulent meningitis have been obtained by combining the clearing out of the ear cavity with craniotomy without opening the dura.

**RULE II.** IN CASE THE ABOVE IS NOT ENOUGH, GO THROUGH THE DURA AND ENTER THE SUBARACHNOID SPACE.—This serious decision should only be taken under two circumstances: (1) When the foregoing intervention has given no useful results. (2) When meningitis sets in in a patient whose ear has already been cleared out, with craniotomy, for lesions localized to the os petrosum, as with our second patient.

A difficult question to settle, with our present data, is what interval should be allowed between the first and second of these

interventions. Still, without lapsing into dangerous procrastination, an interval of a few days should be left between the two interventions, as the favorable action on the meninges produced by the emptying of the ear combined with extra-dural craniotomy demands, even in the most fortunate cases, about forty-eight hours to be clearly effected.

But when the decision has been reached to go through the dura, the surgeon's conduct must be bold. Two things must then be done:

(A) *A crucial incision of the dura.* We are entirely opposed to timid punctures with the knife, and still more so to explorations with the aspirator; free incision alone of the dura enables us thoroughly to inspect the temporal pia mater, or to give sufficient issue to the purulent liquid which may have accumulated there. Furthermore, the brain immediately forms a hernia in this wide orifice and prevents to a certain degree the penetration of the meningeal cavity by secondary infection from the wound.

This incision, in the same manner as lumbar puncture but more effectively, drains and reduces the tension in the sero-purulent collection in the subarachnoid space.

(B) *Exploratory puncture of the temporal lobe.* We think that the dura incision should be completed by one or more exploratory punctures of the brain. These punctures are harmless when done with the following necessary precautions: (1) Use a blunt instrument, such as a grooved probe, but not a knife, so as to separate instead of cutting the nervous fibers of the white cerebral substance; (2) disinfect the instrument thoroughly, as well as the part of the brain surface to be opened; (3) do not enter more than four centimeters in depth. The aim of this puncture is to empty the lateral ventricle if distended by encysted liquid; in some cases it evacuates a latent cerebral abscess.

**RULE III. PERFORM AND REPEAT LUMBAR PUNCTURE.**—Lumbar puncture is a necessary part of the treatment of otogenous meningitis. In order to be therapeutically useful the subtraction of the spinal fluid must be: (1) Abundant; at least fifteen cubic centimeters at a time; (2) Repeated; in our second case four punctures were made in nine days' time, at the request of the patient, who found that they relieved her.

In general terms it can be said that this intervention should be repeated as soon as the temporary improvement produced by the

preceding puncture begins to pass off. There is now no need of demonstrating the absolute harmlessness of this puncture; what we wish to bring into prominence are its advantages.

(A) As concerns the *prognosis*, repeated punctures give us more information concerning the evolution of meningitis than the clinical symptoms. Two signs visible to the naked eye show improvement: progressive clearing up of the liquid and decrease in its pressure. Histologically, the information derived is equally valuable. In cases improving it is possible to see, (1) bacteriologically, either that the germs found at a first puncture have disappeared at the second, or that their virulence has noticeably decreased between the two punctures; (2) cytologically, that the polynuclear leukocytes, very abundant at first, decrease steadily, while the lymphocytes tend to take their place, to disappear finally in their turn. Our two cases were very demonstrative in this respect.

We may add that in more than one instance the patient's improvement was first announced by the clearing up of the puncture liquid before the clinical aspect of the disorder showed any great change.

Still, as a rule, the clinical and histologic improvement correspond with each other.

(B) As regards *therapeutics*, it is not possible to deny that lumbar puncture has an effect. There are clear cases of generalized otogenous purulent meningitis in which lumbar puncture seems to have been the only efficacious therapeutic act. By the side of the possible curative action of lumbar puncture we must emphasize its sedative effect; it sometimes relieves the patient instantly. In short, the treatment of otitic meningitis includes, in addition to the operation on the head, free and repeated lumbar puncture, to relieve the patient's suffering, and with the hope of curing them. It would be interesting to ascertain by what means lumbar puncture gives these results.

The immediate but temporary relief is manifestly due to lessened pressure on the nervous centers through removal of a certain portion of the cerebrospinal liquid secreted in excess; but in Quincke's opinion this removal acts mainly by removing pressure from the lymphatic ducts, which, becoming once more permeable, absorb a great amount of liquid.

The slow but definite recovery seems due, as Brieger points out, to the fact that with the liquid are evacuated a certain quantity of germs and toxins that have gained access to the subarachnoid space, while at the same time the secretion of a fresh quantity of cerebrospinal fluid is solicited in its place, which may have some active bactericidal power.

**RULE IV. THE LABYRINTH SHOULD BE RESPECTED.**—Infection progressing from the ear to the meninges usually follows the labyrinth. Caries of this portion will therefore be found, as a rule, in these oto-meningeal cases. Guided by our two cases, which both presented lesions of the bony capsule of the labyrinth, and in both of which the spontaneous elimination of sequestra enabled slow but definite epidermization of the middle ear to take place without any disturbance of equilibrium, we think it best not to trephine the labyrinth, even if it should show evident necrosis in the wound, but to await its natural healing.

Rash in the past, rational to-day, classical in the future, the surgical treatment of acute purulent meningitis gives us more than hopes; it has already realized reliable results. So soon as surgery shall have emerged from its stage of spell-bound abdominal immobility it will once more begin to go ahead, and will then find in the endocranium a new field for its energy as full of interest as of unforeseen possibilities. The meninges will furnish it with as many pleasant surprises as the peritoneum; but, in order that it may do so, surgeons must think not altogether of the appendix, but of the ear as well.

## CLINICAL NOTES ON INTRACAPSULAR FRACTURES AND DISLOCATIONS AT THE HIP-JOINT

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THE hip-joint is greatly exposed to the effects of violence; in fact, more so than any other articulation in the whole body. This becomes evident when we observe that the hips, notably in women, project far out from the median plane of the trunk, so that when one falls on the side, the site of impact is immediately over the great trochanter. The concussive force is sustained by the projecting neck of the femur, which rests against the fixed pelvis. A double force is brought into action in hip fractures: (1) The impact against a resisting surface, and (2) the counter-coup force through the weight of the opposite heavy hip and the pelvis being brought against it.

But its peculiar anatomic adjustment and its powerful muscular supports give the femoral neck remarkable immunity against fracture until senile structural changes set in. Until these are established the femoral neck rarely, if ever, suffers disorganization from force transmitted from its leverage, the extremity below.

*Direction of Disorganizing Force.*—In more than 150 cases of intracapsular fractures coming under my own care in hospital and in private practice, in no single instance was the injury produced by force transmitted from the foot or the knee. The crushing force in intracapsular fractures must always be direct and concentrated, immediately over the outer aspect of the hip, over the great trochanter. Hence, in all but exceptional instances, when a person about fifty years or over has sustained a violent fall on the hip, and loss of function immediately follows, before we even cast a glance at the limb we may, with a large degree of certainty, predict an intracapsular fracture; in an elderly female, almost invariably.

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<sup>1</sup> On January 13, 1905, by the death of Dr. Manley the profession of this country lost an honored member and an excellent surgeon. This article, received a short time before his death, was doubtless the last contribution to surgical literature that he made.—EDITOR.



*Immediate and Total Loss of Function in the Limb.*—When one has slipped and come down on the hip with such force that he is unable to rise, or support any weight whatever on the injured side, when command over the heavy femoral muscles is lost and the hip and knee-joints are motionless, the evidence is largely in favor of a fracture within the capsule, or possibly through the great trochanter; but the latter seldom, except in consequence of another variety of force. It is true, that at times one may get up and limp over a certain distance after the injury, as after various fractures of the lower extremity; but this certainly very rarely occurs.

Definite diagnosis of intracapsular femoral fracture may be at times simple enough, and again, attended with great difficulty. Cooper said of this serious injury, "The diagnosis is not free from considerable difficulty; some individuals have the rational signs of the accident and yet are not subjects of it, while others who have encountered it may not exhibit symptoms of it."

*The dominant signs of intracapsular fracture* at the hip are, (1) crepitus; (2) shortening of the limb; (3) eversion of the foot, and (4) flattening of the trochanter.

In this fracture crepitus is frequently absent for several days; one may feel the femoral head roll under one's hand, while the other manipulates the thigh in various directions. Some authors attribute this to "impaction" of the fragments, but this view is totally lacking in confirmation by dissection. No doubt, as Brodie, Malgaigne, and others who have made an exhaustive study of the subject point out, it is rather due to an incomplete fracture, or to the fragments being held in position by the periosteum, the thick capsular ligament, and by spasmodic muscular rigidity. Violent manipulation to elucidate crepitus is to be deprecated, whether an anesthetic be employed or not. It may be said that the absence of distinct osseous crepitus is rather the rule than the exception in this injury.

Shortening from one to two and a half inches, Cooper believed almost always took place in this fracture; while Dupuytren is in accord on this point, yet he affirmed that it may not occur for 50, 60, or 80 days after the injury. Porter upon dissecting a subject, the day after complete intracapsular fracture, found no shortening at all. The fracture was complete but not displaced. Carle and Boyer declared that positive shortening was often absent. Stanley, in the

dissection of 13 old cases, found more than one inch shortening in but one. In this instance, quite the entire neck had disappeared by resorption. Sabitier and Gouvsant noted that while shortening of the limb was not always apparent immediately after the injury, it appeared later on. Baron Larry claimed that the limb is rather lengthened than shortened.

The fact is, that primary shortening, forthwith demonstrated beyond doubt, is not common; the lower limbs never measure precisely the same length; and hence, anything less than one inch in retraction cannot be proved to be dependent on fracture. The ordinary mode of measurement is fallacious, or at least unreliable. In actual shortening we must find the upper border of the great trochanter ascending above Nélaton's line a distance equal to the diminished measurement of the limb below.

The greatest degree of shortening after this type of fracture that ever came under my observation was two and one-half inches. In this instance, about six years after the injury, when the extreme shortening was most accentuated, the patient, an aged female, died, whereupon I was enabled to secure the anatomic specimen, herewith exhibited. (Fig. 1.) As may be noted the neck has totally vanished by resorption.

Moreover, it will be observed that we have here an example of "union of the fragments,"—something which all authors agree very rarely occurs, and which no form of adjustment can effect, regardless of what may be said to the contrary. In the case of this woman, no adjustment of any description was worn after the first five days; but she wore crutches for two months, and then limped about without any support. This case further brings home the important lesson that, even though union of the fragments may occur, the neck of the femur is doomed to atrophic resorption, and lameness results.

*Some of the Conditions which Tend to Shortening of the Lower Extremity.*—There is practical unanimity among anatomists that the symmetry of the human frame-work is not perfect. It has been noted, that the lower extremities are not of precisely the same length in the same individual. When this deviation is excessive, it becomes of importance in femoral fractures, notably those of the intracapsular variety.

We shall observe, as we view this aspect of the subject, that diminution in length of a lower extremity proceeds from two causes,



FIG. 1.—External and cut surface of the upper end of a femur six years after a fracture, showing test-tube atrophied head and complete absorption of the neck.



(1) intrinsic or constitutional, and (2) extrinsic or traumatic. Of the former physiologic are the most obvious. In early childhood



FIG. 2.—The neck of the femur during childhood, showing marked obliquity.



FIG. 3.—The neck of the femur during adult life, showing less obliquity.

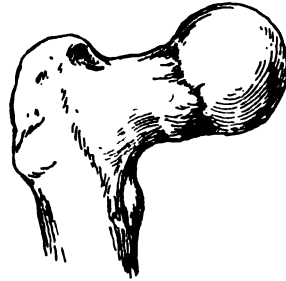


FIG. 4.—The neck of the femur in old age, almost at a right angle with the shaft of the bone.

the neck of the femur is directed sharply obliquely and the hollow of the acetabulum is very shallow. (Fig. 2.) In adult years the neck of the femur becomes less oblique—usually designated the nor-



FIG. 5.—Unilateral coxa vara a cause of asymmetry of the limbs. *a*, the neck deflected and depressed; *b*, the neck compressed and rounded.

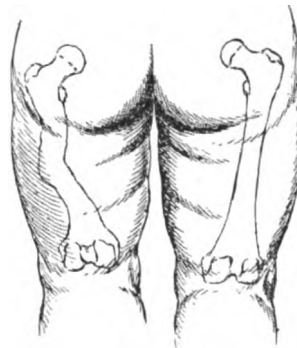


FIG. 6.—Unilateral genu valgum, with obvious shortening on the affected side.

mal contour. (Fig. 3.) In advanced life, the period of the greatest frequency of intracapsular fracture, the neck of the femur becomes osteoporotic and occupies a nearly right angular outline. (Fig. 4.)

Now when these changes proceed evenly on both sides no marked deviation in the length of the legs will be found; but sometimes, because of occupation, involving a greater strain on one limb than

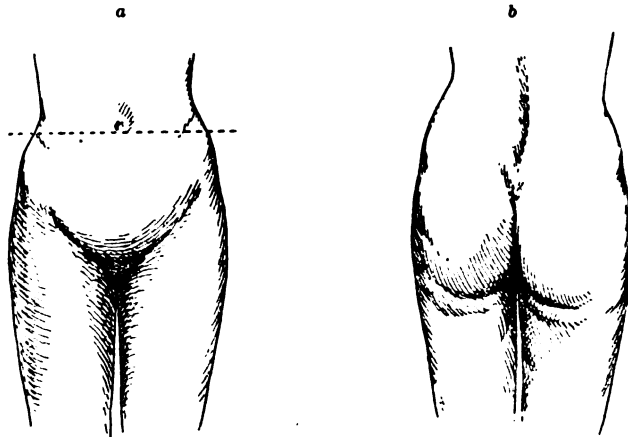


FIG. 7.—Lordosis and lack of symmetry. a, front view; b, rear view.

on the other, or from other obscure causes, senile changes or deviation in length will be observed.

Rickets, a disease well known to involve with greater severity

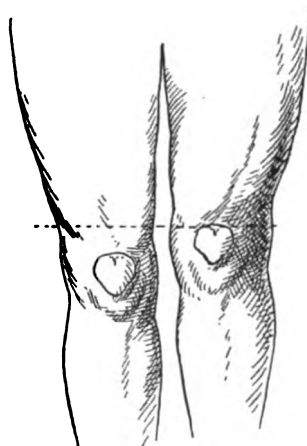


FIG. 8.—Shortening is made evident by the difference in the horizontal plane of the patella borders.

the limb of one side of the body than the other, may be regarded as occupying the second place in this category. In the lower extremity, when the neck of the femur is involved, coxa vara results

with absence of uniformity in length. (Fig. 5.) Rickets seizing on the diaphysis of the femoral shaft induces more or less deflection, and shortening in proportion to the degree of bending. (Fig. 6.)

The lack of symmetry in these cases is usually marked by a hump, lordosis, or curvature. (Fig. 7.) It is important, therefore, when we endeavor to determine with all possible accuracy whether positive shortening be present or not, that we should look to the



FIG. 9.—Displacement upward of the external head (trochanter major) in intracapsular fracture attended with marked shortening.

spinal column and ascertain whether or not there be any deviation in the horizontal prominences of the anterior iliac spines.

Hip-joint disease not proceeding to open suppuration nor resulting in ankylosis, if it extends over a considerable length of time, compels inaction of the limb, or if some form of apparatus that may embarrass the circulation is employed, frequently arrests the growth of the limb, and causes various degrees of shortening. (Fig. 8.)

We may often estimate the relative degree of shortening of the lower extremity in childhood by noting the position of the patellæ.

In intracapsular fracture, when the capsular ligament is torn or greatly stretched, the distal fragment rides far up on the dorsum of the ilium and presents many features in common with a luxation. I have seen more than one case of this type in which definite diagnosis was very difficult. (Fig. 9.)

Violent sprain, or contusion of the hip or a fracture of any area of the femur in a growing child, compelling cessation of function in the limb and the application of mechanical adjustment over a protracted period of time, hampers nutritive processes, retards growth on the affected side, and leaves shortening, which may be detected by accurate measurement in adult years. Eversion of the foot, in these cases, of itself is of no value whatever, for the reason that we observe it, in more or less pronounced degrees, in all severe sprains of the hip. Sabitier regarded this turning-out of the foot as an inevitable effect of intracapsular fracture. Desault alleged that it does not occur constantly. Some authors have observed inversion at first, and later a turning-out of the foot.

We shall do well not to attach too much importance to the position of the foot in complex hip injuries. Stanley recorded an instance of a man of 45, who, after a fall on the hip, was supposed to have a dislocation. There was marked inversion of the foot with shortening of the limb. In consequence of violent and repeated effort at reduction, constitutional disturbance followed and the patient died. Dissection showed no luxation, but a complete fracture through the middle of the femoral neck.

Flattening of the major trochanter can occur when the fracture is oblique, or as a consecutive event after the neck has collapsed and vanished by resorption. Moreover, in very fat subjects it may be difficult to determine whether there is any depression of the trochanter or not: if it does occur, shortening will exist with it.

From the foregoing, it is evident that the diagnosis of intracapsular fracture at the hip is not easy. I have seen the most experienced diagnosticians baffled here.

Again have I seen some of the essential signs absent while indubitable fracture was present. I have seen a case of dorsal dislocation of the hip in a woman treated in a general hospital for intracapsular fracture. The patient's sex and age (55 years) led the examiner to make but a perfunctory examination on her admission. The woman had been out marketing on a winter's evening,



when she slipped and fell on an icy sidewalk. She was unable to rise. An ambulance was called, which took her to a nearby hospital. There a Malgaigne splint was applied; she was informed that she had a bad fracture at the hip, and that as she must remain in bed for a long period they would be obliged to transfer her to Bellevue Hospital. This she refused, whereupon, at her request, she was sent to her own home. It was with much reluctance that I consented to take charge of her, being informed that she had "a broken hip," and knowing that inasmuch as she was a poor woman, proper attendance at home would be scarcely possible. However, I observed a rule, well always to adopt: *never take any man's diagnosis, but investigate critically for yourself.* A dorsal dislocation of the hip was discovered. Reduction was not difficult.

I have seen an example of distinct intracapsular fracture treated as a sprain by a surgeon of large experience. Then, again, the error was made of making a pronouncement prematurely, on the day of accident; a week later, when the patient was seen by me, all the cardinal signs stood prominently out. Time, and time alone, will clear up obscurities of diagnosis in a large number of these cases. Meanwhile, we should exercise cautious reserve in expressing an opinion. There are no fixed and fast rules for treatment in this unfortunate injury. Nothing is lost by delay. Union of the fragments very rarely occurs; but diagnosis is imperative that we may forecast prognosis.

*Intracapsular Fracture in Children.*—One example of intracapsular fracture in early life, which was capable of positive demonstration, has come under my care. This was the only case that I ever saw in more than 20 years of hospital service where fracture cases largely predominate.

The patient was a lad of sixteen years, coming under my notice 10 years ago. Shortly after admission to the hospital he developed typhoid fever, whereupon an abscess formed about the previously fractured hip-joint; the necrotic, proximal fragment was cut down on and removed. He made a good recovery with nearly two inches of shortening, but had a fairly useful limb.

It would appear from various recent publications (notably from those of Dr. Royal Whitman, of New York, and Dr. H. M. Chase, of Boston, Mass.), that fracture of the femoral neck in children is not so very rare. Dr. Chase records five cases treated in the Carney

Hospital, but in no single instance was there a clinical history or proof of fracture immediately after the alleged injury; on the contrary, in every case the pain, weakness, and limb antedated the injury for weeks or months. The only presumptive evidence of fracture was presented by the skiagraph, a notoriously unreliable aid to diagnosis in doubtful fractures in any situation. All of Whitman's three cases lack positive proof of actual fracture at the time they came under his observation. Both of these writers allege that the symptoms in these cases of hip-fracture in childhood are very insidious and come on late.

My own impression is, that these cases were more probably instances of coxa vara or epiphyseal separation.

*Position, etc., in Examination.*—In any severe injury we may derive very important information from a study of the attitude of the limb with the body in various positions. The most helpful is with the patient in a dorsal decubitus on a strong, bare table. The patient should be placed flat on the back with the head moderately raised.

Manipulation should be always gentle but methodical. Should the patient and family be insistent on an immediate diagnosis in an obscure case, we shall do well to warn them that such a degree of force may be called for that an anesthetic will be required, and that violence may possibly be followed by unpleasant consequences.

Fractures through the base of the neck just external to the capsule, or rather through the major trochanter, sometimes occur as a result of direct and great violence. Three such cases have come under my care; all in males under 40 years. In every instance there was extreme intumescence over the external aspect of the hip, soon followed by wide-spread ecchymosis.

Diagnosis of extracapsular hip fracture is not attended by special difficulties. When the line of cleavage is through the great trochanter, in any direction, there is but slight displacement of the fragments, as the osseous parts here are much overlapped by the broad expansion of tendinous structures and held in position by numerous muscles. There is no shortening of the limb nor marked eversion of the foot; but by steadying the trochanter with one hand and rolling the thigh gently with the other, osseous crepitus is readily detected.

I have never encountered intertrochanteric fracture, and hence, from personal knowledge, am unable to discuss it.

Traumatic dislocation of the head of the femur is a rare accident, and belongs to early life, as a rule. The youngest subject of this accident that I have seen came under my care three months ago. She was a patient of Dr. Max Talmey, of New York, who kindly called me in to assist him. She was but 11 years old, and was injured by a fall on the sidewalk the day previously.

When these patients are placed on a firm table, by noting carefully the attitude of the limb and by tracing Nélaton's and Bryant's landmarks, there will seldom be difficulty in discovering their true character. Nevertheless, at times, we are not called until several days after the injury has been sustained; reaction may have set in. Probably it was at first thought that only a "sprain" had been sustained. Now, perchance, we find our patient in an exceedingly irritable state, and the whole limb is hyperesthetic, so that the least movement of it gives rise to the most exquisite torture. Now, let us at this juncture approach the case with an open mind; not forget the exceptions to the rules; not commit ourselves too hastily in the matter of diagnosis, nor urge an immediate examination. The books will not give us much help in many of those cases; there may be no lack of "classic" symptoms, but these are too often delusive.

In cases of intracapsular fracture, with complete separation of the fragments, when the outer head—the so-called major trochanter—rides high up on the dorsum of the ilium, the features of the case are so similar to a veritable luxation that definite diagnosis, until the swelling has subsided, may be next to impossible.

Dr. J. W. S. Gouley related to me an instance which occurred in Bellevue Hospital several years ago, in which an intracapsular fracture at the hip presented so many features of a dorsal dislocation, that several repeated ineffective efforts at reduction were made. The patient soon died from shock. At the necropsy nearly all the deep rotators and the capsular ligament were found widely torn from their insertions. When error in diagnosis, in this class of cases, is possible in the hands of accomplished experienced surgeons, how much more likely is it to occur in the practice of one who only occasionally treats broken or dislocated bones?

## **TRAUMATISM AS AN ETIOLOGIC FACTOR IN INFECTIOUS DISEASES OF THE BONES AND JOINTS**

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MUCH experimental work has been undertaken for a number of years past in order to obtain a clear understanding of the etiologic factor of infectious diseases of the bones and joints, and many of these researches have been successful. We now know that the diseases under consideration can be produced only by pathogenic bacteria which in some way find an entrance into the organism. Experiments and clinical observation also suggested that the presence of these carriers of infection alone is not sufficient to cause their localization in the bones. A predisposing factor is essential which, in the first place, induces an inflammatory process, the symptoms of which give rise to the clinical picture of the disease.

Traumatism has always been recognized to be of considerable importance in this relation, and the older physicians expressed the opinion that there must be an immediate connection between injury and inflammatory diseases of the bones. This idea found its support in the great number of local bone infections originating immediately after an injury. This view was at first only of a scientific interest, but all this changed when its importance in the medico-legal aspects of liability cases came up in the courts—since frequently the question is asked, How far an injury can be made responsible for the development of an infectious disease of the bone. This entailed considerable demands upon physicians giving expert testimony, and made it necessary to explain the relation between traumatism and infectious diseases of the bones. It is probably more particularly for this reason that of recent years a great many tests have been made, both experimentally and clinically, to solve this question.

All this led to the acceptance of the theory of a *locus minoris resistentiæ*, which was believed to be due to circumstances that found general recognition. For example, König states in his textbook that we shall have to accept the idea that the virus circulating in an organism will always settle at a point where the resistance is lessened. This point of lessened resistance will be found in the epiphyseal line in growing subjects; here the small arteries change into large capillaries and the circulation is slowed at this point.

When one takes into consideration that the large majority of cases of osteomyelitis, tuberculosis, or inflammation of the bones and joints, as well as rheumatic and gonorrheal affections of the joints, whether of a spontaneous or traumatic origin, exhibit similar clinical symptoms, it naturally leads one to think of similar conditions found in the traumatic varieties.

It is still legitimate to accept this view, since it finds support in Chauveau's well-known experiment. He observed the occurrence of septic gangrene in the testicle of rams, which appeared only after the organ had been subcutaneously twisted on its pedicle and the animal had been inoculated with pus organisms. This goes to prove that the organ whose blood-supply has been severely interfered with becomes deprived of its powers of resistance to infection, and that the possibility of the development and growth of the pathogenic bacteria in the affected organ is thus increased.

Kocher has stated that if an individual, after having been exposed to a traumatism, cold, or a disturbance of the circulation, has a focus of altered bone marrow, and if pathogenic bacteria are circulating in the blood, the infectious material can act in a way similar to that demonstrated by the experiments of Chauveau.

In this paper, I have endeavored to collect the most important investigations concerning the relation existing between traumatism and infectious diseases of the bones or joints, and shall consider whether the results of these investigations justify the view that the connection is to be explained by the theory of a *locus minoris resistentiæ*, produced by the traumatism, and infection by means of bacteria circulating in the blood. The first experimental work along these lines was taken up some 25 years ago, and although at that time there was a prevalent desire to explain all inflammatory diseases of the bones, especially those of a tuberculous or suppurating type, by the influence of certain bacteria, it was nevertheless

admitted that other etiologic factors were essential, foremost among all being traumatism.

Rosenbach and Krause noted in their experiments on the etiology of osteomyelitis, that the injection of the products of putrefaction into the veins of rabbits' ears leads in the majority of cases to an inflammatory process of the bone, if the bone has been fractured subcutaneously, and that the inflammation closely simulates acute osteomyelitis as met with in the human subject. Becker confirmed the results of these authorities by carrying out similar researches; but he made an additional discovery which appeared to prove the predisposing influence of traumatism. He found that the injection of a culture of *Staphylococcus aureus* (with which organism he experimented at a later date in an endeavor to prove that it is the specific cause of osteomyelitis) produced only acute toxic symptoms and that its influence on the bones is evident only after they have been subjected to a contusion or a subcutaneous fracture.

After these experiments investigations were carried out with a view to produce a localized affection in the bones without the interference of traumatism, and in this, also, experimenters were successful. The work of Rodet and others amply proves this. Not much importance, however, need be attached to these experiments, since they simply show that so-called spontaneous osteomyelitis may arise.

Of far greater interest were the experiments of Rinne, whose results were not in accord with those obtained by the earlier investigators, and were even in direct opposition to them. In a few rare cases only could Rinne produce a metastatic suppuration in subcutaneous fractures, and he was only able to produce it in those cases in which he employed in his inoculations fresh osteomyelitic pus. The injecting into rabbits of a pure diluted culture of staphylococci taken from abscesses gave only one successful result; in the majority of cases his experiments remained negative, the animals showing no symptoms of disease after repeated inoculations. This observer, nevertheless, comes to the conclusion that a subcutaneous injury or a fracture may serve in some cases as a site of predilection for the development of pus organisms circulating in the blood.

On account of the great interest evinced by the profession at large, Ullmann was induced to collect all experimental work which had been done up to that time in order to confirm the results and

develop the subject more fully by further investigations. He also resorted to the use of intravenous injections, but was never able to produce any disease of the bone, still less an osteomyelitis. He was only successful when the bone was exposed to a mechanical lesion, such as a simple contusion or a subcutaneous fracture, and he, therefore, believed that the presence of pyogenic organisms in the tissues or circulation is not sufficient to produce an acute osteomyelitis. There must be a predisposing factor giving an impulse to the localization of the bacteria and their development, and he believes that traumatism has a certain importance in this relation and that it is quite possible that hemorrhages resulting from a contusion represent a *locus minoris resistentiæ*.

More recently the origin and pathology of osteomyelitis has been attentively studied by Lexer, who employed more accurate methods of investigation and obtained results which in part agree with those obtained by Ullmann, and which also have broadened the field in many directions. They appear to be of considerable value because they were adapted to circumstances which arise in the life of human beings, and thus he followed the experiments of the older investigators. He found that after an intravenous injection of the ordinary pyogenic bacteria, they become localized in the bones after a traumatism has been inflicted. The affection produced corresponded only partially with acute osteomyelitis, especially in its clinical picture; in most cases the localized process had to be accepted as a metastatic suppuration of pyemia induced by the pyogenic organism which, although injected in a dilute form, had retained highly virulent properties.

These results suggested the use of an organism which Schimmelbush had succeeded in obtaining in pure culture from a form of suppuration appearing spontaneously in the rabbit. The experiments were at first undertaken with an attenuated culture, as the organism in a highly virulent culture was contraindicated because septicemia so rapidly supervened that the animals quickly succumbed. As far as the results went regarding bone infections, it may be said that spontaneous suppuration with changes in the bone never took place, abscess of the bone marrow was never detected, and periostitis or osteitis was never observed. The only constant condition found was a change arising in the bone marrow which could be recognized macroscopically. This was seen in the

form of a generalized, dark reddening of the tissue with fine grayish yellow dots scattered through it, especially at the end of the diaphysis. Microscopically, these yellowish points were found to be a collection of round cells, which occasionally were found in larger numbers at the end of the bones, where they could be recognized by the naked eye as a highly hyperemic zone. Suppuration in the bone marrow, which was much altered by the inflammatory process, never progressed further, in spite of the fact that the marrow retained within it the infectious agent which could be cultivated directly from it with great ease.

Thus far the results appeared unfavorable, as far as bone infection was concerned, until the animals inoculated were submitted to a traumatism. Lexer produced slight and serious injuries (without involving the skin) at the same time that he inoculated the animals; the results immediately corresponded with the older observations and gave rise to symptoms which closely resembled those arising in acute osteomyelitis following a traumatism in man. Still further research showed Lexer that such localizations of bacteria in bones, which had become predisposed to infection by traumatism, might also arise when no intravenous inoculation of the animal had taken place, and he was able to observe the occurrence of suppuration in subcutaneous fractures made for the purpose of controlling the results, in the rare cases of animals that did not succumb to a general infection in a short time, but which on account of a special resistance survived for from eight to fourteen days.

He introduced cultures of the streptococcus or the rabbit bacillus of Schimmelbush, using the mucous membrane of the pharynx for introducing the infection. This he did in order to ascertain the part played by the mucous membrane as a point of entrance to infection. The experiments with *Staphylococcus pyogenes aureus*, which were of such importance as regards human osteomyelitis, gave almost uniformly negative results. Doses of 0.05 cubic centimeter, which induced death of the animal in 24 hours when introduced by intravenous injection, gave only a few successful results when introduced by the mouth or directly applied to the tonsils. No animal died from the infection, in only one was suppuration of the tibia produced, and this only occurred at the site of a subcutaneous fracture of the bone.

The cause of this peculiar fact probably lies, as has been pointed



out by Lexer, in the different reactions of the saliva which, according to Sanarelli, exercises an antibacterial power over various forms of bacteria.

The first investigations carried out relative to traumatism and its bearing upon tuberculosis of the bones and joints were undertaken by Schüller, but as a matter of fact they differ on general principles but little from the researches of the older experimenters on osteomyelitis. Admitting the fact that diseases of the joints of an infectious nature often develop after an apparently unimportant traumatism, this authority tried to produce infection with *Bacillus tuberculosis* by subcutaneous injections or the introduction within the trachea of bits of tubercular tissue. He employed viscera affected with tuberculosis, such as fungous masses removed from the joints or the sputum of infected subjects. His results both clinically and pathologically correspond perfectly with those obtained by Rosenbach, Krause, and Becker relative to osteomyelitis. In every instance he was able to detect a tumefaction and thickening of the synovial membrane lining the joints which had been subject to a traumatism, and these changes appeared histologically to be identical with tuberculous inflammation of the articulations. A traumatism alone would not produce these characteristic conditions, but the typical picture of a tuberculous synovitis would make its appearance occasionally and at a later date, if the animals became infected during their intercourse with other tubercular animals.

From these results Schüller naturally concluded that a traumatism in some way or other produces a point of lessened resistance, which is a favorable local condition for the influence of infectious organisms.

Some ten years later, Krause again took up the investigation of this question, having considerable advantage over Schüller, inasmuch as his experiments were carried out with pure cultures of the tubercle bacillus, which had not been obtained at the time of the latter's experiments. The animals infected subcutaneously or by intravenous or intraperitoneal injections of a culture of the tubercle bacillus died in a few weeks from a generalized miliary tuberculosis, but they showed a relatively high percentage of tuberculous inflammation of the synovial membrane when injured by a traumatism, and the inflammation found was quite like that of tuberculosis

of the joints in human beings. A fracture or a dislocation of the joint remained free from infection.

The results obtained by Krause consequently correspond in general with those of Schüller, and he concludes by saying that the joints and bones of infected rabbits and guinea-pigs will resist infection, although the various viscera may be thoroughly invaded by tuberculosis. It is only when a joint becomes more highly vascularized on account of a small traumatism that the disease manifests itself in them.

A number of French experimenters soon after this succeeded in producing a chronic tuberculous process of the joints without traumatism by simply using weaker cultures of the bacillus, and from this fact the significance of traumatism as a factor influencing tuberculous localization greatly diminished in value. The fact that there was connection between traumatism and infection of the joints was not contradicted for years, and it was only more recently that some investigators have shown themselves in direct opposition to this theory. Lannelongue and Achard could not, in a single instance, succeed in producing conditions which could be explained as traumatic tuberculosis, although they undoubtedly used pure cultures and induced more or less serious lesions of the bones and joints. After infection of the animals by means of sputum or the introduction of particles of fungous material removed from tuberculous joints or caries of the bone, they were occasionally able to obtain conditions which these authorities did not consider of much value, because the conditions observed could be accepted as metastatic processes, if not directly as septic; on account of its nature, the material could not be controlled, and a mixed infection could not be excluded. They, however, admit that traumatism has a certain influence upon the development of tuberculosis in some few exceptional cases.

Friedreich was never able to meet with a tuberculous localization after bones or articulations had been subjected to traumatism of medium severity. The isolated tuberculous lesions which he found in a small number of animals were seated without exception in spots which had nothing to do with the traumatic influence, and he, therefore, believes that it has not been proved that traumatism has any predisposing action for the localization of the tubercle bacilli in the spot injured. He is, however,

inclined to admit that traumatism is a factor which gives an impulse to the development of a tuberculous affection in the bone or joint which up to the time of the reception of the injury had remained latent.

This view is more especially supported by the fact that patients who are under our observation for years suffering from an infection of a bone or joint which gives rise to practically no symptoms, suddenly take on an acute tuberculous process after a fall or a blow. Unfortunately for us, experiments cannot prove this view because a latent condition does not give a reliable point of attack, and experimental researches would permit only of hypothetical conclusions.

Friedreich's researches were submitted to a critical test by Honsell, who confirmed them in every respect. Inoculating animals with highly virulent cultures in large or small amounts gave a negative result in all cases, but by employing large amounts of dilute cultures he was able to obtain a tuberculous process in the joints in only 33 per cent. of the cases, and in them the seat of the localization was usually in a joint which had been left intact.

It seems, therefore, quite improbable that a traumatism should cause the localization of a tuberculous process, and Honsell, like Friedreich, believes in the influence of a traumatism as far as it changes a clinically latent tuberculous process into an acute one, although he admits that this supposition cannot be proved experimentally.

Concerning rheumatic and gonorrheal affections of the joints not much need be said. These affections are more prone to attack joints which are more frequently used according to the occupation of their owner, and are therefore predisposed to traumatism. On the one hand, rheumatic processes of the joints belong to the realm of internal medicine, and it is only infrequently that they require surgical treatment. On the other hand, investigations relative to the etiology of rheumatism are so recent and unfinished that for the present, at least, experimental proof of its relation with traumatism must be considered improbable. But even in these cases there are certainly reasons which might lead one to believe that a traumatic factor may play some part in the etiology, and Lexer has gone so far as to suppose that this affection is due to attenuated microbes which are not virulent enough to produce

suppuration. Therefore the experiments made with virulent cultures, especially of the streptococcus, would seem to indicate that a traumatism may play a rôle in the etiology of the disease.

As to gonorrheal infection of joints and its relation to traumatism, certain conclusions can be drawn, basing them on careful clinical observation, but they will always be subject to suspicion. Such a relationship cannot be proved because experimental work in this direction is naturally lacking. Animals are immune to the gonococcus. The experiments made by Ullmann on dogs and rabbits gave negative results, although they were carried out with the aim of producing osteomyelitis, and it could not be expected that a subcutaneous fracture would give rise to a nidus in which Neisser's organism would settle and develop, because this bacterium chooses exclusively the mucous membrane and the synovial membrane of the joints for its development.

In a recent work, Perez states that inoculated cultures of *Bacillus influenzæ* cannot produce any localization in a healthy organism. It can only produce pus foci in bones and joints under certain conditions, of which traumatism is important.

The question of whether *Bacillus influenzæ* can or cannot be placed among the various bacteria which Ullmann believes may produce osteomyelitis will not be discussed; the fact is simply mentioned because until recently surgeons paid but little attention to the infectious character of influenza and how far it might be able to produce infection of the bones.

If one considers the acquired experience it will at once be noticed that all investigators admit that traumatism has to a certain extent an etiologic importance in the development of all forms of infectious diseases of the bones and joints. But they endeavor to explain the relationship in different manners. Some of them who support the theory of latent infection see in a traumatism simply a factor in producing an impulse to the development of the disease which was previously there, but clinically unobserved. Others believe that there exists a traumatic predisposition and that traumatism diminishes the ability of resisting, and thus produces a *locus minoris resistentiæ* where pathogenic bacteria circulating in the blood can settle down and develop. The fact that the experimental work relative to tuberculosis supports the first view, while experiments concerning osteomyelitis tend to uphold the latter,

would appear to make it rather premature to consider the justification of both views from one stand-point. One is quite justified in accepting both views, when it is remembered that there are analogous clinical observations, and that both affections are practically the same, only that they are produced by different forms of bacteria.

What I shall now say relates only to tuberculous and suppurative infections of the bones and joints, because these are surgically more important than those due to gonorrhea and rheumatism, and because the researches carried out up to the present time concern them mainly. The clinical observation that typical infectious processes of the bones and joints show that the development of an acute process after a traumatism has been received allows one to conclude that latent foci pre-existing in the skeleton develop rapidly after an injury, such as a blow, contusion, or a fall. All this, of course, is simply an hypothesis, but it is of importance simply because it is difficult to refute. It is quite true that its justification is not easy, and is perhaps even impossible, for there is no means of experimentally demonstrating it, and the clinical observations which originated the theory are not sufficient to uphold a decided opinion on the matter. Many experimental results found by chance, as well as the most recent detailed statistics, can in a way help to prove the reality of this theory, although its main support still lies in the negative results of experiments carried out with a view to prove the presence of a *locus minoris resistentiæ*.

As has already been pointed out, Lexer found a hyperemic inflammatory reddening of the undamaged bone marrow following intravenous injections of cultures of Schimmelbush's rabbit bacillus, and amidst the hyperemia fine punctiform grayish-yellow foci which clinically gave absolutely no symptoms, but which on bacteriologic examination are found to be teeming with bacteria. Ponfick made a similar observation, showing that the bones can be generally involved in typhoid fever and that bacterial metastases can take place in the entire skeleton and make themselves known by the occurrence of proliferation of the periosteum and loss of osseous substance, such as a superficial lesion of the cortex. All these lesions may run their course and disappear without any clinical evidence of their presence.

Lexer was able to show experimentally that after a traumatism an infection of the bone took place at the point of injury, and

Rinne draws the conclusion, from his own experience, that the changes produced in the bone by the deposit of the typhoid bacillus may break down and result in an abscess if the bone is subjected to a traumatic influence. Accumulation of bacteria plays an important part in the production of the osteomyelitis.

Lexer comes to the following conclusions regarding the results obtained by the action of the bacillus of Schimmelbush on the bones: Artificial infection of the blood results in the deposit of the bacterium in the bone marrow, but spontaneous suppuration does not take place. It, however, sets up an inflammatory irritation of the marrow, and if a traumatic influence is brought to bear the result is the severest form of suppuration followed by necrosis.

Honsell says that the relationship between traumatism and infectious processes of the bones and joints is clinically accepted only in those cases in which an uninterrupted chain of symptoms, from the time of the traumatism and the commencement of the tuberculous process, can be demonstrated. It is true that Wiener admits that an interval of a few weeks can elapse between the reception of the injury and the development of the tuberculosis.

Honsell's statistics taken from the Surgical Clinic of Tübingen show that in 180 cases the patients had always been previously healthy and had never had any trouble at the site of the lesion. This relatively common development of tuberculosis in apparently healthy subjects made Honsell conclude that in all probability there was an antecedent latent process which started into activity under the influence of a traumatism, rather than the likelihood of a *locus minoris resistentiæ*. The invasion of the bones by the tubercle bacillus had probably occurred a long time previously, and we know from the statements of Friedreich that the tubercle bacillus may live for years in a quiescent stage in the epiphyses.

Wiener is still more explicit in his statements. He divides his material, obtained from Mikulicz's clinic, into separate groups, namely, those forms of tuberculous affection in which the symptoms directly followed a traumatism, those which had been present before the injury and which showed a change for the worse after it had been received, and, finally, those cases in which, after the initial traumatic inflammatory symptoms subsided, symptoms of a tubercular process supervened after the lapse of six weeks. His study of the latter group of cases leads him to believe that the

theory of a latent process is confirmed; but, on the other hand, taking into consideration the first group of cases, he is of the opinion that traumatism can also exert a direct predisposing influence.

Recurrences of old osteomyelitis after the reception of an injury would, on general grounds, seem to speak in favor of the theory of latent infection. Schulte also looks upon recurrences as probably the result of a traumatic lesion, but he is uncertain whether a traumatism can be held responsible for primary affections.

It will be seen that the theory of latent infection is, to a certain extent, well proved, but nevertheless it found little recognition, and it is only the more recent investigations on tuberculosis that speak decidedly in its favor. The older observers of tuberculosis and osteomyelitis considered a latent affection as exceptional; they believe, in the first place, in the predisposing influence of traumatism; in other words, in the theory of a *locus minoris resistentiæ*.

Let us consider for a minute the predominating view of the latter theory. König states that a traumatism leads to disturbances of the circulation in the fluid entering into the tissues. In the material which is for a short time outside the circulation, bacteria find an excellent media for development. The coagulated extravasated blood simply represents an artificial culture media for the development of pathogenic organisms. In point of fact, Rosenbach's experiments show that a severe bruise or contusion of the bone affects the marrow as well,—shown by the general dark red color extending beyond the line of demarcation of the contusion, as well as by smaller extravasations of blood. According to Jordan, a mechanical injury acts by deteriorating the power of resistance in the injured tissues, resulting directly in necrosis or diminishing its nutrition by disturbances in the circulation.

The investigations of Wyssokowitsch and Orth are quite in accord with Jordan's results. According to them, a lesion of the intima of a blood-vessel may result in a deposit of bacteria, and, according to Orth, this lesion does not induce a deposit of bacteria as a mechanical factor, but is the result of a weakening of the cell energy produced by the traumatism. Lexer also looks upon traumatism as inducing disturbances of the circulation and thus favoring the local deposit of bacteria. This view is confirmed by a case reported by Buschke, observed in the surgical clinic of Greifswald.

It was that of a suppurating fracture in which he was able to detect bacteria deposited originally in the highly vascular tissue of the callus, whence he asserted that this condition was analogous to the localization of the bacteria of suppuration in the physiologically weaker parts near the epiphysis of adolescence.

The results obtained in the researches on osteomyelitis show that the infection of an organism or of the circulation, combined with a traumatism of a bone, always results in a suppurative process at the point where the injury was received, and probably must prove that osteomyelitis, abscess of the bone, and similar affections appearing after the reception of a traumatism, must be explained as the results of a deposit of a bacteria in a *locus minoris resistentiæ* produced by a trauma.

On the other hand, clinical experience confirms this view completely; every-day experience shows that osteomyelitis sometimes develops at a point where the most powerful and active process of growth is going on; at others, at a point where a traumatism prepared the soil. We also see in cases of sepsis and pyemia that metastases are far more likely to take place in bones and joints that have been weakened by traumatism. Finally, from the fact that osteomyelitis attacks males far more frequently than females (according to Schuchardt, four times more frequently), and especially those who are exposed to traumatic influences, shows that the infection starts in a part of the organism whose capacity of resistance is weakened. It is no wonder, therefore, that the theory of a *locus minoris resistentiæ* is generally accredited, at least in so far as its relation to suppurative processes of the bones and joints is concerned.

Funke believes that this theory is so justifiable that he is inclined to think that old fractures which occurred as much as 20 years previously, have a certain traumatic predisposition for osteomyelitis. Ullmann has made a casual remark which is of interest. He believes the cause of osteomyelitis, usually arising in bones in a state of active growth, possibly resides in the fact that in restless children a slight blow or fall would often bring about small extravasations of blood which favor the localization of the bacteria. I would point out that the striking preference for the tibia can be easily explained in this way, since on account of its position it is more exposed to traumatism than any other bone in the body.



As regards tuberculosis we can explain its origin in exceptional cases only by the localization of the bacillus in a traumatic *locus minoris resistentiæ*. That such may really be the case is proved by the experiments by Krause, but we must not forget that his artificially produced tuberculous affections of the joints were only observed in animals suffering from general miliary tuberculosis, which at a later date succumbed to the general process. Krause was not able to produce in rabbits the localized tuberculous process as we meet with it under ordinary conditions in man. More recent experimenters have succeeded in producing a clinical picture corresponding more closely to that observed in man, but their results completely exclude the supposition that infection was due to a traumatic *locus minoris resistentiæ*, because the inflammatory process attacked only perfectly normal joints, or at least showed such a preference for them that the single localization at the point of the traumatism can only be accepted as exceptional. Lannelongue, Achard, Friedreich, and Honsell, therefore deny the influence of traumatism as a predisposing factor in the origin of tuberculous inflammatory processes of the bones and joints.

It may, however, be said that in practice one may accept the influence of a *locus minoris resistentiæ* to be the cause in those cases in which inflammatory lesions directly induced by a traumatism become at a later date more intense, until finally the typical picture of tuberculosis has developed. Such cases may also be explained by the same theory when the immediate results of the traumatism, such as swelling and tenderness, disappear in a few days, leaving behind only seemingly unimportant conditions, but which again change for the worse in the course of a few weeks. This is an important point for the expert on the witness-stand in accident cases, and, although it is true that Honsell defends the theory of latent infection, other observers, as, for example, Wiener, are more inclined to accept a predisposition caused by an injury in such cases.

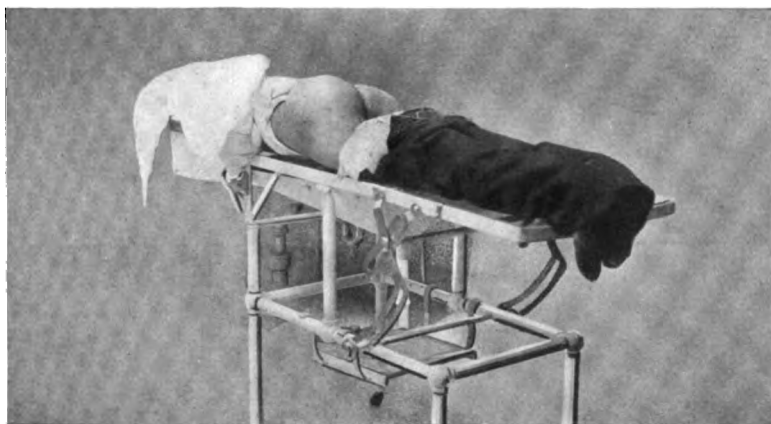
If one now recalls to mind how frequently in an immense number of cases no localization takes place after a traumatism has been received, although an entrance to infection is proved and bacteria are found circulating in the blood, it is evident that we must explain this by different factors. One should remember the local reaction of the organism against invasion of bacteria in the form

of inflammation. The wall of leukocytes thus formed may, perhaps, through the influence of the alexins, weaken or perhaps entirely destroy the bacteria, and may thus prevent their entrance into the circulation.

If, nevertheless, the bacteria succeed in entering the circulation, the infection will depend entirely upon the number of the invading bacteria, as well as on their virulence. The body is able to resist a few attenuated germs, but at some points, when the circulation and nutrition of the part are highly damaged, as in the contusion of the bone, the power of protection is not sufficient for the destruction of the bacteria. They consequently settle in this *locus minoris resistentiæ* and there develop and bring about the clinical picture of a local inflammation. I would also point out that it is more than probable that such occurrences are favored by general debility produced by hunger, anemia, fatigue, or the like.

The experiments of Gottstein show that a change in the consistency of the blood may transform bacteria which were previously non-pathogenic into pathogenic ones, and that the bactericidal properties of the blood may be removed by artificial destruction of the red corpuscles.

To sum up the subject, it may be said that we are justified in admitting that a traumatism reduces the resisting power in the bone tissue in every case, and thus produces a *locus minoris resistentiæ*. The infection of this point at a later date by way of the circulation, presuming that bacteria reach it by this means, depends on other conditions, especially the ability of the organism to resist and the degree of virulence of the invading germs. And still more it must be admitted that, in many instances, the development of an infectious local disease, following a traumatism, can be considered as the lighting up of an old latent process.



**FIG. 1.—Sarcoma of the left buttock.**



**FIG. 2.—Sarcoma of the left buttock.**



**FIG. 3.—Sarcoma of the right buttock (Case II).**

# SARCOMA OF THE GLUTEAL REGION; EPITHELIOMA OF THE LEG; ANGIOMA OF THE LOWER LIP

A CLINICAL LECTURE

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GENTLEMEN: We shall study to-day some interesting neoplasms, the first of which is in a colored boy, 21 years of age, who presents the following history: He has had good health up to a year and a half ago when he began to suffer pain in his left buttock. About one year ago he noticed a mass in the left gluteal region, which was somewhat firm and painful, especially in wet weather. This has grown quite rapidly until at the present time the buttock appears to be distended by a mass about the size of a child's head. The skin overlying the growth is not adherent, but the mass is fixed to the left ilium, is apparently encapsulated, somewhat soft, elastic, and quite vascular. There is no distinct history of traumatism. Blood examination shows 6,120,000 red cells, 4000 leukocytes, and hemoglobin 90 per cent. His urine is acid, has a specific gravity of 1018, and contains no albumin, no sugar, and no casts, but some crystals of calcium oxalate. A diagnosis of sarcoma has been made because of the rapid growth of the encapsulated tumor, because of its vascularity, and because it is unaccompanied by lymphatic enlargement. (Figs. 1 and 2.)

The question of removing this growth requires careful study, and the patient should be made fully aware of his chances with and without operation. In any event, the outlook is quite gloomy. This case recalls one of similar nature, in which two attempts at removal, followed by the injection of Coley's serum, only prolonged life a very short time.

CASE II.—*A rapidly growing recurrent sarcoma apparently springing from the front of the coccyx or the sacrococcygeal ligaments.* The patient is a white girl, 14 years of age. Her ma-

ternal great-grandfather and her great-grandmother died of cancer; one maternal aunt died at 36 years of cancer of the breast. There is no tuberculosis in the family. One year ago she had a fall upon the buttock, followed by a "cake," as she described it, in the right gluteal region near the anus. This subsided somewhat, but an injury in September following caused a recurrence of the enlargement. Two weeks before I saw her she again bruised the part and claimed that the growth had doubled in size in a week. Examination at this time revealed a mass upon the right buttock behind and above the anus. The mass was larger than a coconut, smooth over most of its extent, with one or two points of ulceration at its summit. It was somewhat irregularly globular in contour, considerably inflamed, with a semifluctuant feel. The appearance was that often noted in connection with an inflamed dermoid cyst, and it could readily have been mistaken for one of these cysts developing in the coccygeal region. Careful examination, however, showed that the growth was solid and not cystic, and a diagnosis of sarcoma seemed justifiable. (Fig. 3.)

The growth was removed by a wide dissection with the hope that its rapid advance could be stayed. The wound was not entirely closed, but treated by open method. Healing progressed favorably for several weeks, but never became complete, and six weeks later a local recurrence in part of the wound was quite evident; in four weeks more the mass had reached the size of an orange, but apparently did not extend very far into the surrounding tissues.

Blood examination shows, hemoglobin 85 per cent., red cells 3,672,000, white cells 22,000. On May 13 a radical removal was made by the actual cautery and the patient placed on injections of Coley's serum. The injections were made in the region of the growth at intervals of three days, beginning with very small doses and rapidly increasing. The local wound showed considerable improvement under this treatment, but a metastasis occurred with deposits in the lung and mediastinum, and one small nodule appeared over the trachea at the episternal notch. The patient was free of fever except immediately after the injections were given. No tubercle bacilli were found in the sputum, which was expectorated quite freely. She became more and more anemic and feeble, lost appetite, suffered some diarrhea, and finally died of exhaustion.

Thus, we have an illustration of the course of a rapidly growing

round-cell sarcoma, which the microscopic section shows this to be; certainly a very gloomy picture. The history of the injury is so clear in this case that the question of its relation to the disease is forcibly pressed upon us. While there is no proof that trauma is causative, yet we can readily understand that it may render a part, at least, unable to prevent the development of a malignant tumor. In this case we have, in addition, to the history of traumatism, heredity as a predisposing cause. These two factors, with the essential cause as yet undetermined, give a ready explanation for the rapidity with which the case had progressed. I am firmly convinced that sarcoma is an inoculable disease and that ere long its essential cause will be determined. We are, unfortunately, unable to promise these patients much from any of the present plans of treatment.

Early and radical removal followed by the use of Coley's fluid to prevent recurrences seems to offer the best results, although the outcome in this instance is not flattering.

The Röntgen-ray has not proved of great value in this class of growths.

The next case, which is operative, is particularly interesting in this connection, in that another form of malignancy is present. It followed prolonged irritation, which is often noted in cases of carcinoma. Here a digression into the different factors entering into the causation of tumors, especially of the malignant type, is pardonable, not because we have anything new to offer, but to stimulate further effort to solve this most elusive question. The many theories of the cause of tumor formation have been so well expounded that they are quite well known. Those of Cohnheim and Ribbert are satisfactory for the explanation of a few of the benign tumors, yet they do not account for the development of the malignant growths. The study of heredity, diet, soil, trauma, and irritation in the production of tumors is quite interesting, but has not shown that these are more than predisposing causes, leaving the pathogenic entity still unknown. The question is forced upon us, Are all tumors produced by the same or similar causes? When we recall the fact that many of the granulomas formerly classed as tumors are now considered separately, since their cause is known, must we not admit the probability of other growths being removed from the list of tumors as their causation and development are better

understood? I am inclined to admit that many forms of growth are the result of the presence of excess cells remaining from birth which grow only when properly stimulated. On the other hand, I believe that we must look to an infective agent to account for growth, infiltration, ulceration, and metastases of the malignant tumors. Similar conditions are met with in tuberculosis and syphilis. In the former, no one now denies the organic contagion, and in the latter it is generally admitted, although unknown. All other theories to account for the development of cancerous growths demand an excitant for the cells to assume malignancy. When so excited these cells must be transported to produce metastatic growths. It is, then, not impossible to understand how a much smaller organism than a tissue cell can be carried and excite a secondary growth. The claim is made that were a parasitic organism the cause, the secondary deposits would not assume the type of the original tumor, but rather resemble the tissue in which the secondary deposit occurs. This does not necessarily follow by any means, as we can as readily understand that particles of the original growth carry the exciting agent as we can that transported thrombi carry infective bacteria.

It therefore appears reasonable to believe that we can no more have a metastatic tumor without the exciting entity than we can have a metastatic abscess without some form of pus-producing organism. Nor have we any more right to assume that all malignant tumors have the same exciting cause than we have to believe that every abscess is the result of the same organism. We should not overlook the fact that the slowly developing processes, such as tuberculosis, are not so readily inoculable, do not develop so rapidly, or show the same cellular arrangements, as the more acute infections. We are not going too far, then, in claiming that the cell arrangement in cancerous growths does not preclude an organic contagium. Nor, again, does the infrequency of direct contagion (infection) prove a negative. That such inoculation does occur, we are bound to admit, or doubt the records of Behla and others relating case after case in which this has occurred. When, again, we consider how few surgeons are inoculated with tuberculosis in proportion to the frequency with which they handle cases of this affection, are we not able to understand the small number of cancer inoculations in a very much smaller number of cases. I note here a few illustrations:



Behla<sup>1</sup> mentions the following cases in which physicians have been inoculated with cancer: Albert, reported by Lemiére; and a surgeon of St. Thomas Hospital who died of cancer after tasting cancer juice. Budd in 10 years has seen five surgeons in a cancer hospital die of carcinoma. Emson died eight months after injuring himself at a cancer operation. Guérmonprez mentions a medical student who became infected with an acne bump while examining a uterine cancer.

CASE III.—*Epithelioma of the leg.*

This man, aged 50 years, came to me in January, 1902, to be relieved of a chronic inflammation of the tibia which had existed for 30 years. There had been an almost constant discharge from the bone for a great portion of that time. During the last few months he had suffered more pain than usually, especially at night, and the discharge had become very offensive. He had been able to work through most of these years, but of late could not stand to do his work, although able to walk about.

Examination revealed a limb thickened to about twice its normal size, as the result of osteoplastic deposits produced in the effort at repair. A number of sinuses presented extending through cloacæ to a large sequestrum which included a very large portion of the shaft of the bone. This condition probably resulted from an infection following an injury, as the patient recalls one occurring at the onset of the disease, or it is possible that this was originally a tubercular infection which has been replaced by a pyogenic process. There was no history of syphilis, and the attending physician had already given him a thorough course of antisyphilitic treatment.

Being a laboring man and very anxious to preserve the leg, he consented to a sequestrotomy, which was done January 16, 1902.

All of the necrotic bone was removed with a large part of the involucrum to accomplish this end. A shell of apparently healthy bone was left posteriorly and at the epiphyses. The entire cavity was treated with pure carbolic acid followed by alcohol, then iodoforized and packed with sterile gauze.

The repair proceeded nicely, and in a short time the entire shaft of the bone was reformed except at a point about three inches

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<sup>1</sup> Deut. med. Woch., July 27, 1901.

below the upper end of the tibia, which failed to heal, and a sinus persisted.

After a short time the discharge from this sinus became quite profuse and very irritating, so that the entire front of the leg was covered with a dermatitis. This responded after a time to mild applications. The sinus still persisted, and on April 30, 1902, it was thoroughly curetted with the hope that any remaining dead bone might be removed and repair follow.

On January 10, 1903, the sore was slightly larger than in April, and had commenced to assume the appearance of malignancy, being more painful, bleeding easily, and the edges being raised somewhat, with small abscesses in the skin margin.

A microscopic examination gave no positive evidence of malignancy—only the changes seen in inflammation being found. A more radical enucleation of the disease was made January 19, 1903. A temporary improvement followed this operation, but final healing never occurred. In September, 1903, after a trip to the country, he returned to me with a marked increase in the size of the sore.

The edges were raised a quarter of an inch above the surrounding skin, were hot, rather soft, and presented spots where cheesy masses had collected. The latter were probably collections of dead cells. The veins in the surrounding skin were quite prominent, crusts formed over the sore near the ragged edges, and when lifted seemed to extend into the deeper structures. Free hemorrhage followed the separation of these crusts.

A microscopic section taken at this time showed unmistakable evidence of epithelioma, the growth being composed of ingrowths of epithelial cells, and a number of pearl nests being found. From the appearance of the section it is quite evident that the growth began in the skin and did not attack the bone primarily.

We can readily understand that the constant irritation of an acrid discharge would of a necessity lessen the resistance of the tissues. This with increased blood-supply engendered by the inflammation would produce a field ripe for the development of a malignant neoplasm.

Further than this, we know nothing positively of the cause of this condition. This patient has finally consented to sacrifice the leg, as we believe the disease of the bone, in addition to the malignant growth, cannot be removed in any other way with any degree of certainty.



**FIG. 4.—Epithelioma of the leg (Case III).**



The Röntgen-ray would have been tried in the case had it not been that the patient was unable to make the necessary trips for treatment. The question of time also is to be considered, and amputation offers the quickest recovery and the best chance to prevent a recurrence. In preparing for the operation, the patient has been purged, has had a thorough bath, and the limb has been shaved and sterilized. The diseased portion has been covered with gauze and towels so that it is not exposed during the operation. When the patient is under the influence of the anesthetic, the limb is elevated and a tourniquet applied around the upper part of the thigh. The field of operation is thoroughly prepared, and semilunar flaps made with their bases at the junction of the lower and middle third of the thigh.

The incision includes the skin and the muscular tissue, the latter being cut a little distance higher than the skin, and lower posteriorly than in front to allow for the greater retraction there. The periosteum is divided and retracted upward for about an inch so that it may cover the stump of bone. The bone is then divided, and the main vessels caught and tied; the tourniquet is loosened, and all hemorrhage checked; the muscular flaps are brought together loosely by catgut sutures and the skin wound closed with catgut, save at either angle, where a soft rubber drain is to be inserted to remain two days. A voluminous dressing of cotton and gauze is applied. Having found several lymphatic glands enlarged below Poupart's ligament, we now remove them.

An examination of the specimen shows that the bone has been replaced throughout with what appears to be a healthy bone. There seems to be a very slight involvement of the bone by the new growth which has infiltrated the skin, cellular tissues, and muscles down to the bone over an area three and one-half or four inches in diameter. (Fig. 4.)

The tissue making it up has the same appearance throughout its extent.

CASE IV.—*Large angioma of the lower lip.*

This patient, a white boy, aged 13 years, presents a capillary nevus covering the lower part of the face and part of the neck just beneath the chin. The condition has existed since birth. About 3 years after birth the lower lip began to enlarge; within the last few months it has increased considerably in size but at no time

has it given him any pain. Recently the surface has become abraded from exposure and irritation so that it bleeds freely at several points. When he came to us the lower lip was nearly an inch thick and protruded forward about two and one-half inches, like a shelf on his face. The muscular strength of the lip was insufficient to keep the mouth closed, saliva was constantly dripping, and he presented an unsightly appearance. In other respects the boy appears to enjoy good health.

His mother is living and well, but his father died of cancer.

The question of malignancy must be considered in the case, for it is quite possible that this originally benign condition should undergo sarcomatous change. I am inclined to believe, however, that the condition is benign, as there is no induration about the lip, no tendency to encapsulation, which is so often seen in sarcoma, and no tendency to ulceration. The abrasion present is superficial and is kept up by the child's picking at the lip.

The lymphatics are not enlarged, but this would be expected even in sarcoma. A microscopic examination would be necessary to determine whether the growth is malignant or not.

Many methods of treatment have been proposed for this condition, as ignipuncture, electrolysis, subcutaneous ligation, excision, and the injection of coagulating fluids, such as alcohol, etc., all of which have their uses in certain cases.

Dr. Wyeth has proposed that these tumors be injected with water at the temperature of 190° to 212° F., claiming that it causes a coagulation of the tissues with resulting contraction about the vessels and decrease in the size of the growth. The entire lip being involved in this case makes it probable that an excision would leave the boy with considerable deformity; therefore, I employed the Wyeth method, injecting the hot water into the deeper portions of the growth, several drams being used.

This was done under anesthesia, while the lip was isolated by two clamps, lest there be some coagulation of blood in the veins with resulting embolism. The tension in the lip was perceptibly increased, but the patient suffered no pain; a week later the lip was still swollen, but not as large as it had been immediately after the injection. In another week the lip appeared to be considerably diminished in size, and a good result seemed likely to be obtained. Again the hot water was injected and at two points placed near

the mucous surface. At these points the blanching was quite marked. He appeared a week later with sloughs at each of these points, due, I believe, to strangulation of the vessels of the mucous membrane. Therefore, caution against injecting too large a quantity near the surface of one of these growths is advised. Had it not been for the accident I think the result would have been good. Another week has passed, and I now proceed to excise the lip, which has been prepared in the usual manner. A flexible clamp is fixed at each angle of the mouth, care being taken not to use too much pressure. Two elliptical incisions are now made extending from a point near one angle of the mouth to the other, one passing through the skin almost parallel to the vermilion border, the other in a similar direction along the mucous membrane. The skin and mucous membrane are then dissected back for some distance, care being taken to avoid button-holing the skin.

The growth is now removed, the hemorrhage checked, and the wound margins coapted with catgut. A longitudinal excision was used in this case, because the extent of the cutaneous nevus was such that the ordinary V-shaped incision, sufficiently large, would have resulted in much deformity. Firm pressure is applied upon the dressing to prevent oozing between the flaps.

(One week later the patient returned with the wound completely healed and with remarkably little deformity.)

## THE USE OF SCOPOLAMIN AS A GENERAL ANESTHETIC IN SURGERY

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THE question of surgical anesthesia has appeared to be more than ever one of urgent interest during the last few months. For we now see more and more plainly that an anesthetic that is quite perfect must fill two requirements, though they are of unequal importance to be sure: the one, most important, from the surgeon, who demands that his patient shall be well put to sleep and shall not run any risk; the other, from the patient, who has a right to expect from the operator that an anesthetic shall be administered that is not more disagreeable or more apprehended than the operation itself.

It is from this point of view that the scopolamin method appears to us interesting, since on the one hand it presents a minimum of risk, and on the other a maximum of advantage for the patient. Finally, the technic of its administration is as simple as possible, and requires neither apprenticeship nor special apparatus.

Scopolamin was discovered and first used in Germany, and after having seen the results obtained with it we brought it back from Germany in order to experiment with it in our wards at the Pitié Hospital, where it was first administered in France on December 5, 1904.

The results obtained both by foreign surgeons and ourselves enable us now to give a general description of the advantages as well as of the drawbacks of the method.

First as to the physical and chemical properties of scopolamin. This substance ( $C_{17}H_{21}NO_4$ ) was first extracted from the *Scopolia Japonica* plant by Schmidt in 1890. It consists in prismatic crystals that melt at  $59^{\circ}$  C., are soluble in water, and are very soluble in alcohol and ether. It deteriorates very rapidly when exposed to air or light, whence the necessity of always using perfectly freshly prepared scopolamin.



The salt usually employed is the hydrobromate; it is often adulterated when bought at random, and for this reason the scopolamin prepared by Merck, of Darmstadt, should be exclusively used, being the only kind that is chemically pure.

Physiologically, scopolamin paralyzes the inhibiting action of the pneumogastric, which causes slowing in breathing and acceleration of the cardiac rhythm. Its vaso-dilating properties show themselves in a pink coloration of the face, increased secretion of urine, saliva, and perspiration, and more or less marked mydriasis. On the brain its narcotic action produces irresistible sleep without dreams or delirium.

Scopolamin was used for the first time as a general anesthetic in surgery by Schneiderlin in 1900, but the method found few followers, and up to 1903 no one had recourse to it except Korff, Bumke, Blos, and Witzel. Under the guidance of Korff, however, it spread rapidly, and cases in which it has been used were published in great number, Wild, Flatau, Hartog, Volkmann, Bloch, Israel, Dirk, and Ziffer relating their technic, opinions, and results. Finally, quite recently (December, 1904), Kollitsch has studied the chemical and physiologic properties of scopolamin.

The number of cases of anesthesia by means of scopolamin now published amount to 1488, in which no French case is included; they are divided as follows: Korff 200, Blos 105, Flatau 30, Witzel 3, Wild 7, Stolz 5, Erevsen 69, Hartog 93, Volkmann 20, Bloch 300, Dirk 260, Israel 332, Ziffer 64,—to which can be added the 26 cases at our clinic.

Anesthesia by means of scopolamin is effected with hypodermic injections made with an ordinary hypodermic syringe; its administration is, therefore, extremely simple. But all operators do not use the same solution, nor do they proceed in the same manner. On one point, however, they all agree, all recognizing the necessity of adding a certain amount of morphin to the scopolamin solution, as morphin is a powerful antidote to scopolamin and renders its use harmless. The most important point is the relative proportion that the solution should contain of each of these two substances, not only as regards its harmlessness but as regards its anesthetic effect.

If, for instance, we take the different statistics that have been published, we see, among others, that Israel found that an average

of 9.6 per cent. of patients sleep perfectly without the addition of any other anesthetic, Dirk 11.1 per cent., Ziffer 21.8 per cent., and Bloch 25 per cent.

The technic of these different surgeons is as follows. Prof. Israel gives, two hours before operating, a single injection of  $\frac{1}{16}$  milligram ( $\frac{1}{80}$  grain) of scopolamin, with 2 centigrams ( $\frac{1}{5}$  grain) of morphin.

Dirk, Prof. Rotter's assistant, gives, two hours before operating, a first injection of  $\frac{1}{2}$  milligram ( $\frac{1}{15}$  grain) of scopolamin with 1.5 centigrams ( $\frac{1}{4}$  grain) of morphin, and an hour later, that is, an hour before operating, a second injection of  $\frac{1}{2}$  milligram of scopolamin with 1 centigram ( $\frac{1}{5}$  grain) only of morphin.

Ziffer, Prof. Dirner's assistant (Budapesth), uses a solution containing  $\frac{1}{2}$  milligram ( $\frac{1}{15}$  grain) of scopolamin with 1 centigram ( $\frac{1}{5}$  grain) of morphin per cubic centimeter; with this he makes a first injection two hours and a quarter, a second one hour and a quarter, and a third fifteen minutes, before operating.

Prof. Bloch (Treiburg i B/.), whose technic we have adopted, gives larger doses of scopolamin and makes the injections farther apart, so as to produce as gradually as possible the deepest possible sleep. He uses the following solution:

Hydrobromate of scopolamin,	0 0012 gram	$\frac{1}{80}$ grain ;
Hydrochlorate of morphin,	0 012 gram	$\frac{1}{5}$ grain ;
Distilled water,	1	c.c. 20 minims.

He makes a first injection four hours, a second two, and a third one hour, before operating.

The solution we personally use contains the same relative proportion of scopolamin and morphin, but we give only 1 milligram ( $\frac{1}{4}$  grain) of scopolamin and 1 centigram ( $\frac{1}{5}$  grain) of morphin per cubic centimeter. In this way we have obtained a sufficient degree of anesthesia without chloroform in 26 per cent. of cases, which is almost the exact proportion reported by Prof. Bloch.

In addition to this technic, whereby anesthesia is obtained without the association of chloroform with scopolamin, it is possible, and this is the plan that we think most advisable for laparotomy, to combine scopolamin with chloroform. In that event the amount of scopolamin should be noticeably decreased, one injection only of 1 milligram ( $\frac{1}{4}$  grain) being given two hours before

operating. Chloroform must then be given before beginning to operate. This technic has the advantage of preventing the patient's waiting for the operation, as well as the vomiting and pain on awakening, and we have not to apprehend any contraction of the abdominal wall, or subcutaneous vaso-dilatation. Finally, and especially, by this means, we lessen considerably the amount of chloroform given, and also escape the initial phase of excitement.

The dose of chloroform that is inhaled by the patient is difficult to estimate, as we cannot tell exactly the amount that evaporates and the amount that is absorbed. But whereas with apparatus, whatever these may be, the patient always absorbs exactly the same amount of chloroform as when the latter is given with a compress (for it is not by passing through an apparatus that the narcotic effect of chloroform increases), if we give the patient a dose of scopolamin beforehand that lessens considerably his resistance to the anesthetic, we perceive that a far smaller amount of anesthetic will be necessary for him, to obtain an equal result. Besides, the chloroform can be given with any one of the different apparatus *ad hoc*, which will still more lessen the amount of chloroform employed, though not the amount absorbed.

To cite figures that can be compared: Mikulicz in 1000 cases of anesthesia obtains an average of 80 grams per 100 minutes of anesthesia; when scopolamin is injected beforehand, this average falls to from 14 to 16 grams per 100 minutes of anesthesia.

It should be noted that when we wish or are obliged to employ another anesthetic as well, we must never use ether, but always chloroform. For ether causes considerable congestion of the pulmonary apparatus, which, together with the vaso-dilatation produced by the scopolamin, increases very materially the chance of pulmonary congestion or acute edema of the lung in the days which follow the operation.

When the first injection has been made, the patients feel in twenty or thirty minutes an increasing desire to sleep that is very similar to the physiologic sensation. As a usual thing, they resist for a while, yawn, turn over in bed, their ideas become confused, and their speech unintelligible; but at last their lids close and they lose consciousness. Breathing is remarkably calm, the mouth being slightly open. In many cases the patients execute instinctively certain reflex movements, such as raising the hand to the face,

scratching the nose, or turning in bed; if the covers are taken off they draw them back again.

After the second injection sleep is more profound; still, as a general thing the patients feel the puncture and carry their hand to the spot where it is made. Reflex movements diminish, and breathing, which is very quiet, becomes slightly less frequent; whereas the pulse becomes somewhat quicker. The patients sleep almost always on the back, mouth open, arms under the head, and hands closed; frequently they snore. In many cases they make movements of suction with their lips, as though drinking in their sleep. If at this moment they are spoken to in a decided manner or shaken, they open their eyes with the dazed look of a person roused from a deep sleep, speak a few unconnected words, turn in bed and go to sleep again at once.

After the third injection sleep is usually profound and the anesthesia sufficient; the patients manifest no sensation at all, either when pinched or pricked,—they do not feel the third injection. The face is a little more colored than in a normal state, though there is not the slightest degree of cyanosis; it is pink, not white, on account of the subcutaneous vaso-dilatation, and in some cases is covered with sweat-beads. Breathing is still slower, between 12 and 16 a minute; it is full and deep, the inspiration in particular being prolonged. The pulse is full, strong, regular, but rapid, varying according to the patient between 90 and 120. If the eyelid is raised the pupil is found dilated and raised upward, as in physiologic sleep. The limbs are not entirely flaccid; they can be made to do every movement without effort, there is no resistance, but muscular tonus persists. When allowed to drop after being raised up high, they do not fall in a limp manner as when all muscle sensation is gone, but drop more slowly to the bed.

It is very important to note that however profound sleep may be, if the patient is shaken or spoken to in a loud and decided tone, or if noise is made near him, he wakes up exactly like a man in a natural sleep; but when pinched or pricked, he does not give sign of the slightest sensation. This complete state of anesthesia with continuation of the intellectual functions is particularly striking with the use of scopolamin, which appears to have an exclusive action on the fibers of sensation.

From these peculiarities follow certain precautions that it is

necessary to observe. Thus, patients must be moved with great care, and should not be jarred. Absolute silence must be observed during the entire operation. Such patients must not be shaken, as is often done to ascertain whether they are well asleep. It is also a good plan to blindfold them, for if they awake they begin by opening their eyes, and the sight of the persons around them wakes them up altogether.

When the operation begins it often happens that the patients make a few reflex movements,—with legs, or arms, or even raise the head. In such events they must not be restrained by force, which wakes them up still more; they must be held with great moderation, simply keeping the movement within bounds and bringing the limb gradually back to its primitive position.

Often, but not regularly, as soon as the first incision is made the operator is struck with the flow of blood which is more abundant than usual and necessitates a few forceps on the vessels of the skin; the blood is redder than venous blood and consists more in an oozing than in a flow. It can generally be checked by waiting a moment and exerting pressure on the section by means of a compress; as the wound deepens, the vaso-dilatation is less and the flow of blood normal. We have also observed that when patients sleep well with scopolamin, the vaso-dilatation seems less pronounced.

But it often happens that we are obliged to give the patients chloroform, as they are not deeply asleep; they stir, and hinder the operation. In that event a few whiffs suffice to obtain a state of profound sleep, without a period of excitement or struggling. As soon as chloroform is administered the pupil from being dilated contracts, and myosis replaces mydriasis.

When the operation is finished the patient is carried back to bed with the same precautions as when brought to the operating-room, if no chloroform has been used. He then continues to sleep as quietly as before the operation; breathing is very calm, the patient utters no complaint, and in some cases perspires very freely.

The duration of this sleep varies according to cases; as a general thing it lasts four or five hours after the operation is over, making a total of nine to ten hours in all.

Wakening occurs in exactly the same way as from physiologic sleep. The patients open their eyes, the face manifests surprise at being in bed, and they endeavor to collect their ideas and recon-

stitute the break in their life which they feel lacking; they question their neighbors, ask whether they have already been operated on or are about to be, and as a general rule ask for something to drink, and when they have obtained it fall asleep again for several hours. In some instances they wake up for good, stretch, and rub their eyes as after normal sleep, and ask for food. A number of them would not believe that their operation was over, and had to be shown their dressings.

When they have eaten, provided the nature of the operation permits this, they fall asleep again, and some do not wake up again until the following morning; others sleep a shorter time, or else wake up a number of times during the night; still others hardly sleep at all; but all remain perfectly calm, with no suffering and no impatience. No one of them required morphin during the night.

By the following day the pulse-rate and breathing have become normal again; mydriasis often continues for 24 or 48 hours. The patient has no discomfort, and eats in his usual fashion. But the most curious fact, and certainly the most valuable one for the patient, is the continuation of the anesthesia, which lasts twenty-four hours, in some cases two or three days even, on which account no patient complained of the wound or had the slightest need of an opiate after the operation. This state of affairs we have found constant, and can explain it in no other way than by the absolute calm in which the patient finds himself, which saves him from all excitement and agitation. In no case have our patients experienced nausea, vomiting, or malaise, as happens when other anesthetic substances are used.

On the day after the operation the patients resume in their usual way the diet required by the operation they have undergone; they take up their regular life again, and we have many times found them reading the newspaper. Finally, and this is an important point, none of our patients had any recollection, either of pain or of the operation, even although some of them had shown signs of consciousness during the operation, obliging us to administer chloroform; and this fact is all the more striking in that several of our patients had appeared quite waked up, speaking and complaining as though no anesthetic had been given to them. All were questioned in this respect, and all without exception had entirely forgotten not only what they had said, but that they had felt the slightest pain.

Urine, which was examined in each instance, was found to be absolutely normal in composition; it contained no albumin, as occurs after the use of chloroform. In amount it is slightly increased during the first 24 hours, reaching 1200 to 1500 grams.

The patients on whom we intentionally operated after combining chloroform with scopolamin, that is to say, after making only a single injection two hours before operating and giving chloroform before beginning the operation, show the same symptoms as those to whom three injections are given, although they sleep much less profoundly, as can easily be conceived. With this method chloroform should be begun while the patient is still in his bed, and it should be given very gradually; in this way the patient does not know he is taking it, and passes into a deep sleep without any period of excitement and without a movement. He can then be moved to the operating-room. Much less chloroform is required in this way than even with an apparatus, and in many cases as soon as the first incision has been made the chloroform can be laid aside for the remainder of the operation. When the latter is ended, the patient continues to sleep quietly for several hours, though for not so long a time as when three injections are made; but he is just as calm, presents the same long period of anesthesia, and has no vomiting. Besides, in this way are avoided certain drawbacks to which reference will be made in a moment.

To sum up, the advantages of the method are as follows: suppression of operative apprehension and of the stage of excitement that precedes muscular relaxation, which may mean suppression of initial syncope; absolute loss of consciousness and even of memory; prolonged duration of sleep, eight to ten hours; suppression of vomiting, nausea, and malaise, usually observed after awakening; a calm condition of the patient, who sleeps the following night without requiring morphin; absence of albumin in the urine; harmlessness of the method, which enables it to be used in tuberculous, cardiac, and cachectic cases; finally, the advantage in scopolamin that struck us most forcibly is the continuation of the anesthesia for a long time after wakening in all instances. The patients never complain of their wound during the first two days, as they are accustomed to do as soon as they awake from the usual anesthetics.

By the side of these advantages must be mentioned the drawbacks to the scopolamin method. These are, first, its varying effect,

to which Dirk and Israel have already called attention. Some patients fall asleep rapidly and completely; others with difficulty and incompletely, so that they have to be given a certain amount of chloroform, differing in quantity, but always very much less than when given without scopolamin. The second drawback is the vasodilatation, which often hinders the operator and demands most careful hemostasis to escape the formation of hematoma. Lastly, must be mentioned contraction of the abdominal wall, contraction which persists in spite of the chloroform and which contraindicates scopolamin in abdominal surgery. Still, when a single injection of one milligram is given, no contraction of the wall is observed nor any vasodilatation, although most of the other advantages persist.

Scopolamin is less dangerous than the other anesthetics usually employed, and, when combined with chloroform, lessens the risks connected with the administration of the latter. We call attention once more to the fact that scopolamin should never be combined with ether, whose dangers it *increases*.

As always happens with new things, particularly when they come to us from abroad, critics of the method have arisen. An article appeared in the *Semaine Médicale*,<sup>1</sup> the writer preferring to remain anonymous, in which the great danger in the use of scopolamin is pointed out, and twelve cases of death are spoken of, "notoriously due to the scopolamin-morphin injections." Let us look at these twelve cases, and see what is to be thought on the subject.

CASE I. (Blos.)—Man of 50 years, with very marked pulmonary emphysema, pulmonary tuberculosis, cardiac degeneracy, intestinal tumor, tubercular caries of the pelvic bones, fecal incontinence, albuminuria, temperature 38° F. Resection of several pieces of the pelvis. Profuse hemorrhage during the operation. After the operation the patient seemed to sleep quietly. Six hours later he died by gradual loss of strength. At postmortem, pulmonary tuberculosis and amyloid kidneys and liver. This case, we believe, need hardly be discussed.

CASE II. (Flatau.)—Woman of 52 years, from whom a uterine polyp was removed after incision of the cervix. Sleep was profound during the operation, which was perfectly borne; but four and

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<sup>1</sup> Jan. 11, 1905.



a half hours later tracheal râles appeared, the pulse became rapid and weak, the breathing irregular and with a Cheyne-Stokes rhythm, acute edema of the lungs developed, and the patient died seven hours after the operation. No postmortem. Flatau remarks that this case of death seems to him due rather to exhaustion, which was extreme, and to the condition of the heart, than to the anesthetic used. The point is, whether it was the scopolamin that was the cause of the acute edema of the lungs. But we know that a patient must have either aortitis, or renal insufficiency, to develop acute edema, the injections being inadequate in themselves to produce it. It is a pity, therefore, that the postmortem of this patient was not allowed.

CASES III, IV, and V. (Dirk.)—Three old men, 69, 73, 76 years of age, all with intestinal cancer, succumbed, also “notoriously from injections of scopolamin;” but what was not mentioned is that Dirk adds: “two of these patients had already generalized purulent peritonitis when operated on, their condition, as well as that of the third man, being practically desperate.”

CASE VI. (Israel.)—A young man, with anuria of eight days’ standing,—Israel adds: “operated on in an absolutely deplorable condition,”—died at the beginning of the operation while taking ether, of which 40 grams had already been administered. Is it more logical or probable to lay this death at the door of the scopolamin, which had been well tolerated for several hours, than to that of the ether that was being absorbed by the patient at the time of his death? What we have remarked above about the incompatibility between ether and scopolamin dispenses us from dwelling on this case, in which a serious fault of technic was committed.

CASE VII. (Israel.)—Patient with renal tuberculosis; death in coma three days after operation. In his report the writer does not say what operation was performed, nor what lesions found. But postmortem revealed fatty degeneration of the heart, as well as parenchymatous alterations of liver and kidneys. The interval of three days shows that it was too soon to have caused degenerative lesions, and too late for fatal intoxication.

CASE VIII. (Israel.)—Young woman, laparotomy for peritonitis following rupture of suppurative salpingitis. Death on the third day, with myosis and oliguria. At postmortem, fatty degeneration of heart, liver, and kidneys. The same remarks are applicable here as in the preceding case, though we may add that it is remarkable

that the patient should have shown myosis and oliguria, since scopolamin produces just the contrary, mydriasis and polyuria.

CASES IX, X, and XI. (Ziffer.)—The first, woman with uterine cancer generalized to the pelvis and surrounding the two ureters. Operation not described. Patient died five hours after operation, during which 40 grams of ether had been administered. Symptoms that preceded death not mentioned; postmortem not performed. We will simply remark that in view of her lesions the patient must have been in a condition of extreme cachexia. She had likewise taken ether, which can also, and even more so, be rendered responsible.

Ziffer's other two cases were again cancerous women, one dying five, the other two days after the operation. The writer adds that both were particularly serious ones, with propagation to the lymph-nodes and infiltration of the neighboring organs; "in both instances death occurred through exhaustion and anemia."

CASE XII. (Witzel.)—An old prostatic patient with very serious urinary infection and a false passage. Cystostomy. "Patient died of septicemia, whose origin was anterior to the operation;" such are Witzel's exact words, though they were translated: "patient died not without it being allowable, with some degree of probability, to incriminate, at least in a certain measure, the method of anesthesia."

Such are, in abbreviation, the 12 cases of death "notoriously due" to scopolamin; a glance at them will show that no one of them can be attributed with certainty to this anesthetic.

It should be noticed that the cases chosen to test the method were anything but favorable ones; in fact, it rather looks as though the worst had been taken. It is, consequently, not surprising that the scopolamin did not resuscitate the patients. Furthermore, a surgeon has a tendency, easily understood, to blame the anesthetic rather than himself, for deaths occurring several days after an operation, and which, had he used some other anesthetic, he would have been obliged to attribute either to some operative error, hemorrhage, or infection.

We think, in closing, that for many cases scopolamin realizes a very appreciable step in advance; for this reason we have recommended the method, thinking that it can render in France, where we were the first to use it, the services it renders in Germany, where it has already found many partisans.

# Gynecology

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## THE RATIONAL THERAPY OF UTERINE DIS- PLACEMENTS

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IN considering the most rational treatment of the displacements of the uterus it behooves us, (1) to assure ourselves of the certainty of the diagnosis; (2) to determine accurately the degree of displacement; (3) to ascertain whether the displaced organ is reducible or non-reducible; (4) what are the apparent causes; and (5) is the disorder of place of the uterus associated with disease of the so-called uterine appendages?

It may seem almost unnecessary to refer to accuracy of diagnosis of a uterine displacement. But how often have errors in this matter been made? A congenital or an acquired elongation of the cervix uteri has not unfrequently been taken for a prolapse; and chronic pelvic exudates, filling up the recto-uterine interspace, and descent of the appendages, with or without adhesions, have again and again been mistaken for retroversion. So simple an element of diagnosis as the determination of the degree of the displacement is important, for on its finding rests oftentimes the decision of the urgency of local treatment. Is the uterus mobile and natural in this particular; or is it immobile and fastened in its abnormal posture? A satisfactory solution of this feature in diagnosis shapes materially our plan for management of the case.

Determining the cause or causes implies a most thorough and complete gynecologic exploration. Successful treatment of any uterine displacement necessitates the ascertainment of how much the perineum has been injured in parturition, and how much the pelvic floor has been lacerated or unduly stretched. Again, the detection of any evidences of tears of the cervix uteri, together

with ascertaining the condition of the endometrium, and with it the verification of how much the blood-supply of this organ is increased, are vital questions in every case, before any plan of procedure is outlined.

The recognition of the four cardinal principles of the pathology of displacements of the uterus is so satisfactory that they suggest the most reasonable method and means of treatment. It is not unfair at this time to state that there is no group of gynecologic affections so complex; none involving a more comprehensive knowledge of morbid pelvic conditions; none on which so many unnatural changes within the pelvis either precede, follow, or accompany, than do these various uterine versions. The four etiologic factors of displacements in general are: (a) Increased bulk and weight of the uterus; (b) increased intra-abdominal pressure from above; (c) increased traction from below; and (d) relaxation of its supports.

All individual conditions may clearly be classified under one or more of these headings.

What is the normal position of the uterus? Enough to say that there is no fixed or settled position of this organ. It must move and be ever changing its position and relations, altered as it is, by the changing postures of the body, and the functional movements of the bladder and the intestines; by sexual intercourse; by menstruation, by pregnancy and parturition; and by the prevalent customs of dress. In some there is an excessive mobility of this organ, it being at one time anteverted, and at another retroverted. Fritsch, of Bonn, Germany, asserts that no so-called displacement is abnormal; that retroversion is not unnatural. The true position of the uterus can best be determined, when the patient is in the erect or horizontal posture, and after the bladder and the rectum have been evacuated. Truly it may be said that only wide departures from the normal constitute pathologic malpositions.

Nothing can be more uncertain than reliance on the symptoms of displacements to detect either its presence or its degree. Various symptoms are present in many cases of minor displacements; again, they are entirely absent, even in conditions of major displacements. We may observe the same symptoms whether there is, or is not, displacement. Not unfrequently, too, do we accidentally discover uterine displacements when not a single symptom

is complained of. However, symptoms usually manifest themselves, sooner or later.

Evidently too much stress has been placed on the seeming symptoms. As a consequence, grave disasters have come from excessive local treatment. As there is no relation between the severity of the symptoms and the degree of malposition, and as there are no pathognomonic symptoms of this morbid condition, the only rational explanation of the symptomatology is, that the presence or the absence of symptoms is owing, largely at least, to the presence or absence of changes in the blood circulation; or, it may be, to the existence of some complication. For instance, I have not unfrequently observed a marked procidentia uteri, when little or no discomfort was complained of. On the other hand, there have been constant and painful symptoms with slight retroversion, but adherent the uterus was in some cases; and associated it was in others, with a prolapse or some disease of the appendages.

Let the circulation of the blood be impeded within its vessels by traction,—and all of the pelvic contents show a blood stasis. A varicose state of the veins of the broad ligaments, the pampiniform plexus, especially the left, causes a dull aching pain.

Engorgement, therefore, seems to me the chief underlying factor of the symptomatology of this uterine pathology. No better proof of this assumption can there be than that such patients naturally assume the recumbent posture, to obtain relief from their pelvic discomforts.

A pure displacement of the uterus always means some hernia of the pelvic floor. Any impairment of the integrity of the perineal structure is a passive cause. We see at times much uterine displacement, without any seeming impairment of the perineal structures. A complete rupture of this body does not necessarily cause any displacement of the uterus, although some damage to the perineal structures is a prime causal element, by weakening the pelvic floor, thus allowing some prolapse of the pelvic contents. Probably, the most serious mistake, when relief is not afforded to the pelvic symptoms of uterine displacements, by vaginal plastic operations, is the failure to rectify completely the abnormal relaxation in the pelvic floor, brought about by the undue stretching of this most important intrapelvic support, during some previous parturition.

So long as the utero-sacral ligaments retain proper tone and

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strength, swinging, as they do, the cervix high in the hollow of the sacrum, so long retroversion is impracticable; for it is to some disease of these ligaments that we are to look for the cause, at least in part, of backward dislocation, and to their restoration for its relief.

Excessive relaxations of the pelvic floor, following forcible and long-continued stretching in parturition, are worse in effect than perineal lacerations, because they are so often not noticed and not understood, and because they are more difficult to overcome.

A not uncommon cause of retroversion, occurring as it does after an abortion or parturition at term, is the faulty position of the lying-in, then enforced or allowed; prolonged, it may be, with the patient in the dorsal decubitus. At this time the uterus is always enlarged and heavy—heavier in its posterior wall, because there thicker and more hypertrophied. This condition, together with manifest relaxation of the surrounding supports, always predisposes to backward movements.

Further aided this faulty direction is, by a too firm application of an abdominal bandage, forcibly tightened, it may be, to restore the symmetry of a virgin waist. The levator ani muscles and the pelvic fascia constitute the pelvic diaphragm; on it the abdominal pressure from above largely rests.

A practical application and a full recognition of these causes urges the obstetrician to insist that all lying-in women assume, for the most part, the lateral decubitus, within a few hours after parturition, and maintain it for some two weeks; and for weeks longer, when lying down. Many retroversions could thus be prevented; many backward dislocations of the uterus could thus be materially improved or entirely remedied at this time and in this simple way.

Some women have submitted to unnecessary and awkward local manipulation, in attempts to have corrected seeming malpositions of the uterus, without fully and practically having considered for them, whether the symptoms complained of are independent of, or consequent on, this special disorder of place.

The intimate relationship between the pelvic symptoms and the state of the general health is forcibly illustrated by cases, in which there are no local manifestations of any pelvic disease, so long as one remains well in general. But let such a mother suffer

some unusual shock, physical or mental; let her realize some deterioration in her physical standard of health, she will then speedily commence to speak of a backache, a sensation of pelvic weight and heaviness, to have an irritable bladder, and some menstrual disturbances. It is not so much the moderate prolapse, the slight abnormal anteversion, or the trifling retroversion which she has, as it is the signal infringement of certain causes upon the nervous system at large, which cries aloud for help. The uterus itself is in the same position as before, but the woman's general health has been hurt. The uterus is not materially diseased, because it is slightly bent or turned one way or the other. It is not the displacement so much as it is the antecedent physical ill-development, or the constitutional depreciation of her standard of general health, which disqualifies her.

No more clear evidence in a medical sense can be presented that it is not the malposition of the uterus, but the altered blood stasis of this organ, which is the underlying cause of the pelvic symptoms in such cases, than the fact that in anteversion relief is obtained by introducing within the vagina an Albert Smith pessary—not within the anterior vaginal cul-de-sac (the ordinary method of treatment for anteversion by this instrumental support), but by its insertion, as is usual for retroversion, into the posterior vaginal cul-de-sac, thereby actually increasing the anteversion, but at the same time lifting the displaced organ within the pelvis, and insomuch facilitating its impeded blood-supply. All well-fitting pessaries act by improving the circulation. Then, without doubt, this means of uterine support acts in part through its psychical influence, as well as by the physical changes induced.

There are many cases of chronic ill-health of women, arising from various causes, not dependent on any special intrapelvic disease, in which some uterine displacement is detected. It is the easiest matter for the medical attendant to infer and state that, this changed position of the womb is responsible for the general derangement of her health, when probably it is but incidental, and in no way has acted as an etiologic factor. If, under such circumstances, an active local treatment is carried on, the constitutional impairment of health is perpetuated, if not aggravated. The disorder of place of the uterus is trivial, as balanced against the causes arising from general influences.

Now, in the management of any uterine displacement the first and most important of all things is to have a correct estimate, as far as practicable, under which of the aforementioned causative factors the individual case may be classified; together with a thorough appreciation of all the local uterine and parauterine lesions and conditions. A complete and accurate diagnosis of the intrapelvic conditions—uterine and parauterine, and from it the deduction of a rational treatment, are by no means always easy of accomplishment.

Experience unmistakably proves that, while a displacement is occasionally the primary link in the chain of the pelvic disease, as a rule, the disorder of place of the uterus is only secondary to some recognized disease. To secure success in the treatment, this must receive proper consideration, and that, too, early in the management. It may be an easy matter to replace the uterus, and possibly retain it in normal place, but such does not imply a cure or even a relief.

The attention to the improvement of the general health, by diet, by regulation of exercise and rest, by baths and medication, is to be fixed at once. Proper posture of the body, in standing, walking, sitting, and lying down, is not to be neglected. The mode of dress and a suitable adjustment of the garments about the waist, and the suspension of the skirts upon the shoulders, instead of the waist, need special supervision. Always must attention be directed to the relief of constipation—a condition more common, and in many ways more hurtful, to females than males.

The second consideration looks to the betterment of the local uterine and periuterine alterations of circulation. This implies that, in the diagnosis of the displacement and its degree, it is to be settled whether the special dislocation is or is not reducible. In no form of this disease is this element of diagnosis more necessary than in retroversion. A reducible retroversion calls for a very different treatment than does a fixed, adherent one.

Always abate the local inflammation and improve the pelvic circulation, of the active or passive kind. Diminish the uterine weight and bulk, by rest, saline purgation, and local depletion: as by puncturing the cervix at intervals, or by a thorough sharp curettage, followed by copious, hot douches, given with the patient in the recumbent posture. The topical application of the glycerites



of boric acid or alum do good, because of their local depleting effects, and because, properly placed, and made of absorbent wool, they mechanically direct the position, and hold the dislocated organ in an elevated position. In both particulars named, the congested states of the uterus and appendages are improved.

A subinvolted uterus, a chronic endometritis, and a lacerated cervix uteri need especial preliminary consideration, before any efforts are made to retain the uterus in proper position. Too often the whole train of symptoms is attributable to an old bilateral or stellate laceration of the cervix. Flexions associated with versions imply some interstitial change in the uterine parenchyma—a relaxation, an attenuation, a fatty degeneration.

To strengthen the intrapelvic supports by general tonics and local astringents; to reduce the intra-abdominal pressure from above by the judicious adjustment of the clothing, by the maintenance of an erect posture of body, and by the conservation of the normal angle of  $55^{\circ}$  of the pelvic brim to the horizontal plane, to increase the parenchymatous tonicity of the organ by the administration of quinin, strychnin, ergotin, or electricity, are ever constant indications.

In all retroversions the broad and the round ligaments are more or less lax, and the uterus itself is in a state of passive hyperemia. The aforementioned measures, faithfully and skilfully followed, may be all that is required, if the dislocation is easily reducible.

Before we admit the advisability of a pessary, or the performance of any special surgical operation in many cases, it is worth the while to inquire what certain electrical currents may do. It is but fair to state about this therapeutic agent in gynecologic practice, that the Faradic electrical currents do promote uterine contractions, do stimulate a sluggish pelvic circulation, do strengthen the surrounding pelvic supports. This is true whether the anode or the cathode is placed within the vagina. Generally, however, the cathode is to be chosen and adjusted closely against the displaced organ.

The use of one or the other pole of the primary direct faradic current with slow interruptions should be determined by the menstruation,—its frequency, quantity, duration, and the presence of pain. For the most part, the intrapelvic pole, from a short wire, wholly intravaginal, best stimulates to contraction the uterosacral

ligaments and the pelvic floor. So important are these structures in maintaining the uterus in its normal posture that, nothing, not even pelvic massage after Brandt, gives these structures equal tone and strength. Faradization of the intestines above the pelvic brim has a favorable influence on any coexisting constipation. Electricity used this way is essentially a pelvic tonic.

What now is the field of utility of the vaginal pessary? A pessary for the relief of uterine displacements is a necessary remedy for some, fortunately not all, patients. Using it now, it is true very seldom as compared with twenty-five years ago, nevertheless we are not prepared to discard it, and probably never will cease to utilize it in a few properly selected cases. Like a crutch or cane for lameness, it has its place. Some women, for instance, suffering from uterine displacements, always experience comfort from its use, will consent to nothing else being done, and clamor for its continuance.

And why is it they feel so much better? Not simply because the womb is lifted or directed, but because it is changed for the better in its circulation.

But seldom does a real cure follow its use. This statement implies that cures—symptomatic cures at least, do follow occasionally. Personally I confine its use almost exclusively to prolapse and retroversion in certain cases, seldom employing it for anteversion. In all cases its adjustment should not only be comfortable, but its use should create comfort.

The persistent use of an Albert Smith or a Thomas modification of a Hodge pessary, at first short and with a slight curve, gradually increased in curve and in length, will enable one at times permanently to restore the uterus to a normal position. It must take out all slack of the posterior vaginal wall.

The pessary will give much satisfaction in appropriate cases of uterine displacement, in which the congestion and inflammation of this organ has been relieved or improved; cases also in which there is no periuterine tenderness; always certainly, after the displaced organ has first been replaced, but remains not in position; and after, of course, the removal of all contributing causes. That it is not always so useful when indicated is the fault, not of the means, but of a want of proper regard for clear indications and contraindications for its utilization. The pessary

is never intended for constant or indefinite use. It is a temporary expedient; yes, a necessary evil. Its judicious adjustment requires a thorough knowledge of gynecic pathology, much experience, and not a little tact in manipulation.

Tampons of absorbent wool are better than those of cotton. Dry or medicated with some suitable medicament, they are always indicated in the early treatment of uterine displacements; for their mechanical support, if applied well as to place and to size; for their decongestive effects, to better the local hyperemia. Of course, their place in therapy precedes the use of a pessary. I am partial to the use of a lotion, composed of the boroglyceride and the glycerite of alum, equal parts, medicated further with thymol, about one dram to a pint. This lotion is incorporated into a broad tampon of absorbent wool, and adjusted well up into the posterior vaginal cul-de-sac, while the patient assumes the knee-elbow posture, having, of course, previously had a thorough vaginal cleansing.

Too much stress cannot be laid upon the maintenance of an angle of about  $55^{\circ}$  of the plane of the pelvic brim to the horizontal plane. Its significance is greater than would appear at first sight, in diminishing, as well as in directing, the superincumbent weight of the abdominal viscera. The promontory of the sacrum ought to be some four inches higher than the top of the symphysis pubis. This pelvic angle of  $55^{\circ}$ , when much diminished, becomes a serious drawback to the rectification of prolapse and retroversion, especially in feeble and elderly women.

Conditions of prolapsus uteri, and especially of retroversion, are always relieved in some measure by the knee-elbow posture; so that it is well to urge strenuously such patients to assume such a position for half an hour once or twice daily.

Having now improved the general health as much as possible; having regulated the movements of the intestinal canal; removed or mitigated, as far as practicable, any antecedent or coexisting chronic pelvic inflammation; considered the indications for, and the need of, any vaginal pessary, and the use of the faradic electrical currents, it is well to inquire what other means, especially surgical, are called for each individual case.

In the first place, all lacerations of the cervix uteri, of the vaginal canal and the perineal body, should be repaired as soon as expedient, whether associated or not with versions or flexions

of the uterus. Such injuries with their results are always sooner or later attended with, or followed by, some dislocation of the womb. The following, for instance, is by no means an uncommon clinical history. A labor long and painful, with imperfect cervical dilatation, maternal exhaustion, the fetal head in the pelvic cavity, the application of the obstetrical forceps, a lacerated cervix, slight septic infection, delayed uterine involution, some prolapse and some backward movement of the uterus, on and after the erect posture is undertaken; finally backache, lower abdominal uneasiness, leukorrhœa, too early return of the menstrual flow, which in time manifests itself by a menstruation too often, too long, and too much. The permanent rectification of said displacement is only secured by a treatment, consisting of an attention to the removal of the endometritis, the repair of the torn cervical lips, the diminution of the size and weight of the subinvolted uterus, etc., before any direct efforts are made for the correction of the displacement.

A skilfully performed sharp currettement of the whole endometrical cavity; a tracheloplastic operation, or some modification thereof; a well-timed colporrhaphy, anterior or posterior; a perineorrhaphy, not simply for a torn perineum, but also for any manifest relaxation of the pelvic floor, do remove primary causative factors in many cases, and do pave the way for the proper use of other suitable measures, if needed.

Various major operations have been recommended. In the last twenty-five years, as pessaries have been gradually going out of use, many surgical procedures have come into play.

Perhaps there is no part of the whole field of the subject of uterine displacements which has excited so much interest and discussion, none which to-day is so much still *sub-judice*, as, What is the best surgical movement to be made in this direction.

The Alexander operation has its place in gynecologic therapy, but in my judgment its field is very limited. It seems to me it should be confined to cases of slight descent of the uterus, associated with retroversion and flexion, in which the displaced organ is easily replaceable, free from adhesions, and not complicated by tumors or diseased appendages; and, finally, to such cases as are not satisfactorily relieved by mechanical supports or other simpler measures. It is only fair to state that almost any displacement, which can be benefited by an Alexander operation or its modifica-

tion, can likewise be equally improved without any operation whatsoever; simply more time is needed. It is not worth while then, it seems to me, to give it further consideration.

Abdominal hysterorrhaphy or ventro-fixation or suspension has a seemingly wider field of usefulness. We should ever bear in mind, however, that the position of the uterus after ventro-fixation is not physiologic. Belonging as does this organ, not to the abdominal, but to the pelvic cavity, and susceptible as it is in natural conditions to many varied movements, it must be recalled that hysterorrhaphy fixes it and in the abdominal cavity; both of which are unnatural. There must be some danger in certain instances of an intestinal obstruction, by its artificially made ligaments and attachments; and, by an enforced impracticability for an easy and natural progressive growth, with its changing positions, should pregnancy occur; and later on, there is very apt to be great hinderance in delivery of the fetus should parturition at term follow. I have performed this operation but twice in hospital practice. While the patients experienced relief therefrom, I have been unable to follow their cases. It is quite popular in parts of Germany, but there the social relations and the national form of government are very different from those in this country. It probably never will be popular with us.

It would seem rational to discard hysterectomy for any otherwise curable displacement of the uterus during menstrual life, but it is justifiable for marked prolapse or procidentia in certain cases, when pregnancy becomes impossible, because of age or any artificial menopause.

Neither an Alexander-Adams nor a hysterorrhaphy will relieve the symptoms of any displacement unless the pelvic circulation is bettered.

If the uterine appendages are seriously diseased in a case of retroversion or retroflexion, and if the uterus is irreducible or fixed in any awkward position, because of adhesions, an abdominal section becomes clearly indicated, to remove the damaged structures. At this same time the uterus may be liberated, replaced, and put into a normal position.

Hysterorrhaphy must often be supplemented by a plastic, vaginal and perineal, operation, to secure the best results.

When some shortening of the round ligaments by the abdominal

route is done after an exsection of the damaged tubes and ovaries, it is permissible and advantageous at times, to anchor the stump of the broad ligaments to the abdominal wall, at the site of its section. Various technics of shortening the round ligaments have been and are done, as Wylie's, Mann's, and Byford's. They differ in method, but the object of each is to draw upon these ligaments, by shortening them, so that the upper end of the uterine lever is pulled forward and downward, and the lower end is tilted upward and backward—the uterus is anteverted and steadied. Byford's method does this well, in that these ligaments once shortened are fastened to the interior abdominal wall. All of these surgical operations are as yet more or less on trial, but it is unquestionably very reasonable to infer that all intra-abdominal methods which do not seriously impede normal mobility of the replaced dislocated organ are the ones demanding our most serious recognition.

Shortening of the long round ligaments is slightly more dangerous than is the Alexander operation, but while not more so than is ventrofixation, it is vastly superior to any other operation in its ultimate results for good.

Most emphatically can we say then, that no method of shortening of the round ligaments is equal to the intra-abdominal. The folding up and stitching together of the layers of these structures are done as the necessity of each case requires; at the same section, all associated morbid entities of the uterine adnexa are removed or rectified surgically under the naked eye.

A vaginal hysterectomy is uncalled for, even in extreme prolapse, unless in the very aged; for then the natural resiliency and integrity of the soft tissues of the pelvis are lost by senile changes, rendering any plastic procedures less effectual.

In a word, it may be said that a great many surgical operations have been performed in recent years for the rectification of posterior dislocations of the uterus, most of which, while ingenious, are more or less dangerous, unsatisfactory, or useless. I am not disposed to accept the recommendations made that all uterine displacements should be corrected, by some means, and the organ maintained in position at all hazards. Always ought we to recognize the complexity of the local pelvic conditions, and that more than one structure is almost always involved. These diseased

changes have been going on, in most instances, for many months, if not years; consequently the morbid chain is always more or less complicated.

My experience compels me to refer again to the great opportunities and advantages we possess, in dealing with many cases of this kind, by the utilization of plastic uterine and vaginal operations. A well-performed Hegar operation on the perineum and the posterior vaginal wall, in which the denuded area should vary in length, breadth, depth, and shape, always being, however, somewhat triangular in form, is a wonderful boon to women suffering from many intrapelvic infirmities, due directly to injuries incident to parturition and their after consequences. It is to these parts, torn and relaxed, what the Emmett operation is for lacerations of the cervix. Thoroughly done, any lateral elytrorrhaphy is uncalled for.

The Stoltz operation on the anterior vaginal wall, now generally accepted as the proper procedure for cases of cystocele, and any prolapse of this anterior partition wall, can, it seems to me, be much enhanced in its execution and results, by the denudation of a rather long, deep, elliptical area, varying in shape somewhat to suit individual cases, and the firm stitching together of the raw surfaces with sutures of silkworm-gut, run transversely, not circularly, as originally suggested by its author. A thoroughly done Stoltz operation, modified as recommended, and an equally broad and deep Hegar operation, with sutures of silkworm-gut and catgut, passed deeply and transversely, to catch up and draw together the separating muscular fibers of the levator ani muscle, may so narrow and strengthen the vaginal canal that a descending uterus cannot pass through it. Some intra-abdominal operation must, however, eventually be done, to secure perfect and continuously good results.

In the denudation of the special areas of the Stoltz and the improved Hegar operations, care should be taken that abundantly wide and deep raw surfaces are made into the muscular coats of the vagina; so that when the sutures are passed transversely, a firm and strong supporting partition are secured and maintained.

It is best, when there is undue relaxation of the pelvic floor—as there must always be in conditions of procidentia uteri—to utilize a continuous suturing of the deeper pelvic fascia, with the finest of catgut, done surely before the more superficial layers of silkworm-gut are adjusted. These methods of suturing secure com-

plete and accurate coaptation of the opposing denuded areas, and provide for a thorough reconstruction of a solid perineum and a strong vesico-vaginal septum.

Finally, it is apparent from what I have said that a correct appreciation of what we should do for any woman laboring under the discomforts of a uterine dislocation, requires an advice and a treatment always judicious; at once suitable, for her individual condition and needs. Here, as elsewhere in medicine, we are called upon to individualize our treatment for every patient. I have endeavored to lay down the general principles, which should guide us to the solution of each problem. I have purposely said much in reference to the pathology of these affections, for the reason that it becomes essential for us to comprehend thoroughly this feature, as well as how the chief causes in general may conduce thereunto, in order that we may clearly grasp what should be the most rational therapy.



# Ophthalmology

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## THE CLINICAL SIGNIFICANCE OF EXOPHTHALMOS <sup>1</sup>

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THE term exophthalmos, although probably associated mostly with Graves's disease by the general practitioner, is applied symptomatically to any condition in which there is protrusion of the eyeball from its orbit. One or both eyes may be affected, and in different degrees—from a slight prominence with a widening of the palpebral fissure to the actual displacement of the ball beyond the lids. The slighter degrees are hard to detect, unless one eye only is affected, and we can judge by comparison with its fellow. Care must be taken not to mistake a long eye in a shallow orbit for exophthalmos. A patient with myopia naturally has prominent eyes. This is especially apt to cause confusion where only one eye is highly myopic, while the other is normal. The ophthalmoscope will clear away lingering doubt, and the examination of the relation of the ball to the orbit will disclose exophthalmos, if present. If there is true exophthalmos, the palpebral folds are soon obliterated, and closure of the lids is incomplete. If there is displacement, the normal relations of the two eyes will be disturbed, in consequence of which objects will not be focussed upon corresponding points of the two retinae. Diplopia or double vision will then be produced, provided that both eyes can see. The protrusion of the ball makes it difficult, and at times impossible, to keep the lids closed, and the cornea then suffers from exposure. Its ulceration is a frequent complication, and must be guarded against. A lesser evil is the

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<sup>1</sup> Read before the West Philadelphia Branch of the Philadelphia County Medical Society.

annoyance from the tears flowing over the cheeks instead of through the lachrymal canal. This is due to the lachrymal puncta being pushed from their natural position against the eyeball. The lower lid frequently is everted, and its mucous membrane, being thus exposed, becomes eroded and thickened.

With minor degrees of exophthalmos, the normal "S"-shaped curve of the optic nerve allows for the increased tension made upon it, but with a rapid or great proptosis the nerve becomes inflamed and atrophy results. The movements of the ball are at first hampered and later abolished.

What is the clinical significance of this condition? Consider the structures within the orbit and its environs. Remember it is a bony pyramid with its base or entrance *only* irresistible to pressure. If anything invades the orbit, room must be made, and can be had in one direction only,—forward. The inner wall is very thin in the lachrymal and ethmoidal portions. The ethmoidal, sphenoidal, frontal, and maxillary sinuses are in such close proximity that disease of these is liable to affect the orbit. The ophthalmic vein, a tributary of the cavernous sinus, and the ophthalmic artery, a branch of the internal carotid, place the orbit in direct relationship with the cerebral circulation. The orbital circulation thus must necessarily at times take part in intracranial complications.

Given a patient with exophthalmos, unilateral or bilateral, after excluding exophthalmic goiter, we immediately suspect some increase in the orbital contents to be the cause. It may be due to tumors, inflammations, traumatism, sinus disease, or anomalous vascular conditions.

Exophthalmic goiter is a general disease with exophthalmos, tachycardia, enlarged thyroid gland, a fine tremor, mostly of the extremities, and nervous irritability as its cardinal symptoms. There are also changes in the skin, alimentary canal, genito-urinary, vascular, and respiratory organs. It is found in women between 20 and 30 years generally, but men may be affected. The proportion is given as 4.6 to 1. The tachycardia and nervous irritability are always present, the former being the first to appear. Exophthalmos is absent in one-tenth of the cases, and goiter in one-twelfth. The exophthalmos is generally bilateral, though a few one-sided cases have been reported. It may be slight or quite marked, but the staring eyes make it noticeable. The eyes are pushed straight

forward, and even with the most exaggerated cases the motility is very little impaired. About six ocular phenomena of exophthalmic goiter have been described, but all need not be found in the same case, and, in fact, seldom, if ever, are.

Von Graefe's sign, when present, is almost pathognomonic. It consists in an impairment of the consensual movement of the upper lid with the eyeball when the latter is rotated downward. Normally, the lid should follow the eyeball in this rotation, continually covering the upper portion of the cornea. When, however, Von Graefe's sign is present, this relationship is disturbed, and the cornea passes from under the lid, exposing a narrow band of white sclerotic between the cornea and the lid margin.

Dalrymple's sign is due to a retraction of the upper lid and a widening of the palpebral fissure. A ring of white sclera is seen surrounding the cornea, which gives to the patient the stare so characteristic of this disease. This may, however, be present without exophthalmos.

Stellwag's sign is the infrequent or imperfect winking.

Rosenbach's phenomenon is tremor of the upper lid when the patient attempts gently to close the eyes.

Möbius's sign is a diminution in the power of convergence, without disturbance of the power of lateral duction. This weakness does not produce diplopia, but asthenopia.

Joffroy's sign is the smoothness of the forehead when the patient attempts to look upward with the head inclined forward. Normally, the frontalis muscle is called into action to elevate the brow, but the exophthalmos renders this unnecessary.

The most disappointing feature of this disease to the ophthalmologist is the absence of any changes in the eye-ground. The vessels have been reported to be slightly dilated and tortuous in a few cases, and one writer has reported arterial pulsation in 10 out of 13 cases, but usually the fundus is normal.

The exophthalmos is probably due to an increase of blood in the orbital vessels. This is demonstrated by the diminution of the exophthalmos under pressure and by the fact that it disappears after death. There is also an increase of fat in the orbit. This, however, may be secondary to the vascular conditions. The pulse-rate ranges between one hundred and one hundred and sixty, and may even reach two hundred a minute. The heart's action is very marked,

and can be felt by the patient. Even the peripheral arteries may show the pulsation. The thyroid enlargement is moderate: not so great as in other varieties of goiter, and pulsation can be seen and felt. It may be unilateral or bilateral, but one side is generally larger than the other. The other symptoms belong rather to the domain of general medicine, and it is, therefore, unnecessary to discuss them here.

If the cornea is threatened from exposure, the palpebral fissure may be shortened by tarsorrhaphy; or, if this is insufficient, the edges of the lids may be denuded and the two united by stitches throughout their entire length. The fissure at the proper time can be reformed.

Drs. Posey and Swindells reported before the Ophthalmic Section of the College of Physicians of Philadelphia a case of unilateral exophthalmos in a woman aged 22 years. The left eye suddenly became proptosed following a fright. The exophthalmos was of moderate degree, and the goiter was bilateral, the right side being the larger. Marked improvement followed the rest cure, galvanism, and syrup of hydriodic acid internally.

As tumors comprise 41.7 per cent. of the diseases of the orbit, they are the most frequent cause of exophthalmos. The direction of the displacement is of diagnostic value; a tumor within the muscle-cone, for example, pushes the eyeball directly forward. Early blindness indicates primary involvement of the optic nerve. Late blindness develops in the majority of cases of orbital tumor. They generally cause pain, and diplopia is often the first symptom.

Sarcoma of the orbit is the most frequent and the most malignant. In the orbit, it is generally secondary to sarcoma of the choroid, which has broken through the sclera, although it may arise primarily from the orbital connective tissue. The growth is very rapid, and usually free from pulsation and fluctuation; the eyelids generally remain soft and free, while the ball itself is proptosed and almost immovable. Primary carcinoma of the orbit is rare, but may start from the lachrymal gland. It is generally secondary to a similar growth on the lids or conjunctiva or within the nasal cavity. Both sarcoma and carcinoma demand early removal, for if allowed to remain they push the eyeball further and further forward, and form a disgusting, ulcerating, bleeding mass which soon becomes inoperable. Generally the entire contents of the orbit should

be removed (exenteration). As benign tumors may also cause blindness from pressure, early removal is for them likewise necessary.

Vascular tumors, such as angiomas and aneurisms, are found in the orbit, and may be diagnosed by being more or less reducible upon pressure. The aneurism will suffer much greater reduction than will the angioma. Vascular tumors become more swollen during acts of crying, straining, etc. Bruit and pulsation are generally present, and, if so, form valuable diagnostic points.

Osteomas are usually attached to the frontal sinus or to the roof of the orbit, hence the eyeball is displaced downward. Dermoid cysts of the orbit are generally situated anteriorly at the inner or outer angle, so do not, as a rule, cause exophthalmos. The most common site for a meningocele is up and in, so care must be taken to differentiate between the latter and dermoid. Both are congenital. The meningocele is probably more elastic, but careful aseptic puncture is sometimes the only means of diagnosis.

A curious variety, known as intermittent exophthalmos, may be mentioned here in connection with angiomas. In these cases the eyeball falls forward when stooping or when lying face downward, and exophthalmos can be voluntarily produced by compressing the jugular vein or by holding the breath, thus raising blood-pressure, even when standing upright. Upon relaxing the pressure, the eye recedes again into the orbit. The condition is supposed to be due to a varicosity of the veins in the orbit. Such a case has been recently reported by Dr. W. C. Posey, in a young man, a student of pharmacy, whose left eye had been affected since he was four years old. He could voluntarily cause this eye to protrude fifteen millimeters. His vision was unaffected.

Inflammatory conditions of the orbit are estimated at 41.3 per cent. Although all do not, yet periostitis, gumma, orbital cellulitis, and phlegmon may cause exophthalmos. Orbital periostitis generally follows injuries in syphilitic or tuberculous subjects, hence it affects the most exposed portions, the margins, and would not in this locality displace the eyeball. If it should be deeply situated it might cause exophthalmos. It is accompanied by a boring, deep-seated pain which is quite characteristic, and gently tapping around the orbit will elicit tenderness. If gently pushing the eyeball backward produces great pain, the condition is not periostitis, but more likely cellulitis or tenonitis.

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Gummas of the orbit occasionally occur. When they do they produce nocturnal pain, and simulate a true tumor by producing exophthalmos and great immobility of the eyeball. Marked fixity is characteristic.

Hochheim has collected ten cases of tumor in the orbits or eyelids, in patients with well developed pseudoleukemia. Since then Ahlström has reported a case of bilateral exophthalmos, due to pseudoleukemic tumors within the orbits. The exophthalmos was the first symptom, and preceded by two months the glandular involvement throughout the body. This author says that symmetrical orbital tumors are almost always leukemic or pseudoleukemic.

Inflammation of Tenon's capsule may cause exophthalmos. It is diagnosed by vesicular swelling over the scleral insertions of the recti muscles. Among its causes may be mentioned infection from squint operations and rheumatism. Hyperostosis and exostosis may also cause exophthalmos.

Orbital cellulitis is inflammation of the fatty cellular tissue within the orbit. It varies from a mild grade with swollen lids and conjunctiva and slight proptosis with only local symptoms to phlegmon or orbital abscess, in which condition the eyeball is pushed far forward and is immovable. The lids are "greatly swollen, tense and dusky." The conjunctiva is often so swollen as completely to cover the cornea, which may slough. Pressure on the optic nerve causes neuritis and atrophy. The congestion may give rise to thrombosis, which may continue into the cavernous sinus. If the abscess is allowed to point, it generally does so through the upper lid, just beneath the superior orbital margin. Constitutional symptoms are present, as with other infections. The attack begins with a chill, followed by fever. The history is usually one of injury, whereby a septic body is introduced into the orbit; a previous operation; transfer of inflammation from the orbital walls; erysipelas; or metastasis in infectious fevers. Early and free incision into the region of the abscess is indicated. The position of the abscess is determined by the direction of the exophthalmos: that is, if the eye is pushed down and out, the abscess is up and in.

Cavernous sinus thrombosis is either marasmic, or secondary to orbital thrombosis, or to thrombosis of the other sinuses. The symptoms are, first, those of venous stasis; second, those of pressure, and, third, those of paralysis. The lids and conjunctiva are greatly swollen, the swelling even extending over the face. The exoph-

thalmos at first slight, becomes pronounced. The nerves in the cavernous sinus, the third, the fourth, the ophthalmic division of the fifth and the sixth, may all suffer, but the third is the one most often affected. This causes the eye to be turned outward. The process may be carried to the cavernous sinus of the other side by way of the circular sinus, and exophthalmos of the fellow-eye follows. This transference from one side to the other is pathognomonic, and serves to differentiate cavernous sinus thrombosis from other forms of orbital disease with exophthalmos. Swelling over the mastoid aids in the diagnosis.

Traumatism may produce exophthalmos either by the hemorrhage caused or by fragments of fractured bone being driven into the orbit. Fracture may result from a direct blow at the margin or occur by contracoup. In case of fracture of the ethmoid or of the other bones enclosing sinuses, we have emphysema and a marked exophthalmos. This is easily diagnosed by the crackling of the skin under the fingers, the ballooning of the lids, the proptosis when the patient blows his nose or coughs, and the ease with which the ball can be forced back, due, of course, to the great compressibility of the air. A rather remarkable case of traumatism was recently treated at the Presbyterian Hospital in the out-patient service of Dr. William T. Shoemaker. The patient was caught between cars while coupling them, receiving three distinct impacts, and said he was squeezed until his shoulders were almost touching. His head was not injured, yet his eyes felt as if they were bulging out, and he saw double for several hours. The lids and bulbar conjunctiva were purple, and the cornea seemed to be in a depression from the intense chemosis. The hemorrhage was probably due to the venous stasis caused by the great thoracic pressure.

Gunshot or punctured wounds and fractures at the base of the skull may result in the condition known as pulsating exophthalmos. This is a proptosis in which the veins of the conjunctiva are swollen and tortuous, and in which a bruit can be heard over the orbit and, in fact, over all parts of the skull. It is felt by the patient, and at times the eyeball can be seen to pulsate. The bruit is accentuated by anything which increases the blood-pressure and diminished by compression of the carotid. It has been found in the majority of cases to be caused by a communication between the internal carotid artery and the cavernous sinus, which in turn was the result of a basilar fracture. With arteriovenous communication there is

obstruction to the outflow, the blood-current is reversed, and the veins carry arterial blood. It is true, this condition may result from other causes, such as true aneurism of the ophthalmic artery or of the internal carotid artery; but in the majority of cases—60 per cent.—it is traumatic, and the history of a blow or of a fall with unconsciousness will give a hint as to the diagnosis. Ligation of the common carotid on the side of the lesion is the treatment if compression does not promptly improve the condition.

Exophthalmos may be due to disease of the accessory sinuses, if the natural orifice is occluded and the secretion causes sufficient distention or goes on to suppuration. The first stage of the disease is marked by continuous dull pain and tenderness when the affected sinus is percussed. With frontal sinus involvement there is headache over the root of the nose; in antral disease, pain over the upper jaw. In ethmoiditis there is pain, tenderness over the lachrymal bone, mental depression, and asthenopia, and pus in the middle meatus of the nose. Sphenoiditis is probable if pus is found anteriorly in the olfactory cleft, posteriorly on the superior or middle turbinals, on the roof of the choanæ and vault of the nasopharynx. In acute cases there is a bulging of the wall of the sinus in the olfactory cleft; associated with these signs are pain, ocular disturbance, and somnolence. When there is distention, the diagnosis is aided by the direction of displacement of the eyeball. Frontal sinus distention shows itself at the upper inner angle of the orbit, and the eye is pushed down and out. If the ethmoid is the one affected, there is exophthalmos and the eye is pushed outward; crepitation can be elicited. If the antrum is distended, there is exophthalmos with upward displacement. Distention of the sphenoid would cause sudden blindness, because of pressure on the optic nerve, and the exophthalmos would be forward. If pus is formed, there is danger of orbital abscess with its complications.

Transillumination will establish the diagnosis, and the rhinologist with the improved methods at hand can prevent the later stages, so that it is only the neglected cases that fall to ophthalmologists. These cases demand surgical treatment, incision, and drainage.

In a brief summary, such as a paper of this kind must necessarily be, it will be appreciated that it is impossible to enter into detail, but enough ground has been covered to show that exophthalmos is a symptom of many and varied conditions, and is often of grave import.



# Rhinology

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## THE SYMPTOMS AND DIAGNOSIS OF THE SUPPURATIVE DISEASES OF THE ACCESSORY SINUSES OF THE NOSE

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In discussing the symptoms of suppurative diseases of the accessory sinuses, we may well follow Hajek's classification:

(a) Local symptoms; (b) general symptoms; and (c) symptoms produced by complications.

### LOCAL SYMPTOMS

*Headache* is especially frequent in the acute forms of accessory sinus disease, but is by no means a constant symptom in the chronic form. In the chronic form it may be regarded as an accompaniment of exacerbations of the inflammatory processes, or as an indication of obstruction to the escape of secretions. Headaches which recur with every attempt at physical or mental exertion or after unusual indulgence in tobacco or alcohol may occur in empyemas which are otherwise symptomless (latent empyemas). Such individuals, according to Hajek, may go through life under the diagnosis of "habitual headache," and undergo every sort of care—electrotherapy, hydrotherapy, sea-bathing, massage, etc., without the source of their trouble being discovered. It is probably correct to say that the diagnosis of "nervous headache" should not be accepted until a careful rhinal examination has excluded disease of the accessory sinuses.

The headache accompanying disease of the accessory sinuses is of a polymorphous character; that is, it may be neuralgic or diffuse (irradiating), or a combination of the two. Chiari systematizes these headaches as follows:

(a) It may be occasioned by the fever which frequently accompanies the acute inflammation. It is described as a sensation of pressure or fulness in the head, or it may be of a lancinating character, and is increased by stooping or sudden movements of the head. This form usually subsides with the acute symptoms, and is not especially noteworthy; but in nervous individuals or in those having a tendency to migraine it may assume much greater intensity.

(b) It may be present as frontal pain or as a sensation of pressure over the inner angle of the eye, and is probably to be traced to irritation in the region of the frontal sinus or its excretory duct.

(c) It may appear as a rheumatic headache, which has a predilection for the scalp of the occipital region and accompanies taking cold in rheumatic individuals.

(d) According to Eulenberg, migraine or hemicrania is occasioned by irritation of the trigeminal meningeal branches which lead to endocranial circulatory oscillations. The source of such irritation may be in the nose or accessory cavities, but even in such cases it is most frequently accompanied by constitutional anomalies.

The neuralgias which accompany disease of the sinuses are chiefly confined to the frontal, the supra-orbital, the infra-orbital, or the maxillary, and the supradental nerves. The terminal branches may be simply irritated, and this irritation may by irradiation be conveyed to the trunk of the nerve, or the end branches may be involved in a true neuritis or perineuritis, which may extend to the nerve-trunk. When such a neuritis or perineuritis is established, the neuralgia so caused may last long after the original inflammation has subsided, and the possibility of such an outcome should be borne in mind in the prognosis. A feature of the pain of the neuralgias accompanying diseases of the accessory sinuses, which is as peculiar as it is inexplicable, is its periodicity. It appears usually at the late morning hours or toward noon—10 or 11 A.M.—and lasts until the middle of the afternoon; rarely does the pain begin at night.

There is nothing, therefore, pathognomonic in the headaches or neuralgias which accompany disease of these sinuses to differentiate them from the same phenomena occurring in other diseases, such as anemia, nephritis, cardiac or stomach disease. Indeed, even in the presence of inflammatory disease of a sinus, we should be on our guard against regarding it as the causal factor of headache, lest other disease of far greater etiologic moment exists. Again, the most advanced disease of these sinuses may exist without pain being present at any time. Nor is the localization of pain typical for any particular sinus. The pain from ethmoidal or antral disease may be projected to the frontal region, or that of empyema of the sphenoidal sinus to the occipital region. However, in acute disease of the frontal and the maxillary sinuses the localization of pain on pressure over these respective areas is fairly constant.

*Secretion.*—The presence of a mucoid, muco-purulent, or caseous purulent secretion, which may be more or less fetid, is the most constant and prominent symptom of inflammatory disease of the accessory sinuses. The amount of secretion, both in the acute and the chronic forms, may vary greatly in amount, according to the activity of the process. When such a discharge is bilateral, we are justified in strongly suspecting the existence of an empyema.

*Disturbance of olfaction* is frequently present, and is due either to the mechanical presence of the purulent secretion in the olfactory fissure, or to an inflammatory change or degeneration of the nerve endings. Frequently these patients complain of an intolerable stench which is not apparent to the observer. Subjective kakosmia is most frequent in empyema of the maxillary sinus. Such individuals have erroneously been regarded as subjects of olfactory hallucinations of central origin. They frequently complain of a foul taste in the mouth, especially on awaking in the morning. Nausea and vomiting occur and may be erroneously attributed to gastritis, which either does not exist or is consequent upon the empyema. There is nearly always more or less interference with nasal respiration. This is due to the presence of the secretion itself or to polyps, hypertrophies, spurs, or deflections of the septum. Reflex symptoms, such as bronchial asthma, occasionally occur, but are due in all probability more to the polyps or hypertrophies, intranasal pressure, etc., than to the empyema *per se*.

Consecutive infections of the post-nasal space, pharynx, larynx,

trachea, and bronchi are very likely to follow if empyema of the neighboring cavities persist. A typical form of this kind of inflammation is that which attacks the posterior wall of the larynx, and which resists all local treatment until the primary source of the disease is overcome.

#### GENERAL SYMPTOMS

*Fever* is a nearly constant symptom of acute inflammation of the accessory sinuses, and is to be ascribed to the general infection of which the empyema is a localization. In the chronic forms it is inconstant, but slight elevations of temperature are much more frequent occurrences than is generally supposed. A sudden elevation of temperature in the chronic empyemas accompanies perforation of infectious material through a sinus wall into a neighboring cavity or tissue (orbit, cheek, cranial cavity, etc.).

*Symptoms of Congestion and Depression.*—Under this head may be grouped hyperemia of the face; scintillations before the eyes; decrease in frequency of the pulse; intolerance for tobacco and alcohol, because of the intolerable congestion which they produce in the head; irritability of temper; insomnia and the general symptoms of neurasthenia, palpitation, especially after eating, indolence, somnolence, hypochondria, aprosexia nasalis,—all of which may be regarded as a direct result of a chronic sepsis.

Passing now to a discussion of the symptoms and diagnosis of disease of the individual sinuses, I shall begin with the maxillary antrum, and shall speak first of the subjective (local and general) symptoms.

#### MAXILLARY SINUS

Pain in acute inflammation is sometimes present over the anterior wall of the maxillary antrum, especially over the processus frontalis. Not infrequently the patient complains of a sensation as if the teeth on the affected side were too long or longer than their fellows. Empyema of dental origin is sometimes preceded by the well-marked pain of dental caries. Most frequently, however, the symptoms of acute coryza mask any local symptoms on the part of the antrum. Neuralgias of the trigeminus, in connection with antral disease, may be marked, but are not so frequent or so intense as those which accompany inflammation of the frontal sinus. I believe, with Hartman, that the neuralgias accompanying frontal

sinus disease are due to an irritation set up in the frontal sinus duct rather than to pressure of secretion within the sinus itself.

The discharge in disease of the maxillary antrum is usually expelled through the anterior naris. When, however, there are accessory openings, the discharge may find an outlet in the post-nasal space. In acute cases there may be no discharge for several days, and the pain comes to an end by a sudden discharge of mucus from the nose. The amount of the discharge varies greatly in the chronic and in the acute cases. In many cases of chronic maxillary sinus disease, notwithstanding that the maxillary is the largest of the accessory cavities, the patient does not complain of discharge, but rather of other symptoms on the part of the pharynx, as a dryness, or hoarseness from disease of the larynx. Only on rhinoscopic examination is the true origin of the symptoms disclosed. Then, too, in many cases of chronic disease there are periods of cessation of the discharge through the nose which may mislead the practitioner into a false sense of security. Indeed, the periodicity of the discharge from maxillary antrum disease is fairly characteristic of discharge from this cavity, a fact explained by the comparative position of the outlets of the various sinuses.

The outlets from the frontal and ethmoid sinuses are situated at their most dependent parts, while the ostium maxillare is situated far above its floor.

Eczema of one introitus is a fairly constant symptom of maxillary sinus disease. The general symptoms, such as fever, anorexia, depression, are insufficiently mentioned, and are present in the acute and chronic inflammations of the maxillary sinus in common with those of other sinuses.

The presence of a purulent secretion in the nose is one of the most important symptoms, and in numerous cases its presence and location would attract our attention to one or the other of the accessory sinuses. If, after thoroughly cleaning the nose with pledgets of cotton, the head is bent well forward and to the side opposite to that on which the diseased maxillary antrum is situated, one finds a discharge of pus coming from between the upper attachment of the inferior turbinated body and the middle meatus at about the middle of its middle third, we may be reasonably certain of the existence of empyema of Highmore's antrum. However, it is not conclusive for all cases, as the discharge may be insufficient or too

thick for passage through the ostium maxillare, or the ostium may be too small. Occasionally, by posterior rhinoscopy, we can find the mucopurulent secretion coming from an accessory opening of the maxillary sinus. Again, it is possible by reversing Politzer's procedure, that is, by suddenly exhausting the air in the nose, we may be able to suck the purulent secretion of the maxillary antrum through the ostium. However, if by any of these procedures we do not find pus in the region or coming from the ostium maxillare, we cannot make a positive diagnosis of absence of disease of this or other sinus.

*Atypical Hypertrophies of the Middle Meatus.*—Occasionally, in disease of the maxillary sinus, we find about the ostium maxillare peculiar sodden, local hypertrophies of the mucous membrane, which, when once seen, arouse our suspicions immediately as to the existence of maxillary sinus suppuration. These hypertrophies have a peculiar succulent character, are slightly granular on their surface, and are caused by the mucopus which is extruded through the maxillary ostium.

It is unnecessary to mention polyps as a concomitant of maxillary sinus disease. Their presence, however, is by no means pathognomonic of suppuration of the maxillary sinus or of the ethmoidal cells. The mucous membrane covering the process uncinatus and the bulla ethmoidalis may be involved in these atypical hypertrophies. The difference between the mucous membrane of the two nasal chambers is often a valuable factor in arriving at a diagnosis as to the presence of unilateral empyema. Indeed, one side may be entirely normal, while the side, on which disease of the maxillary sinus is situated, presents a succulent, moist character. In many cases it is the rhinoscopic examination which arouses our suspicion as to the existence of suppuration in an accessory sinus. Swelling of the cheek and pain on pressure over the antrum may be the result of an osteomyelitis of the anterior wall of the maxillary sinus, or they may be due to a periostitis, which is entirely separate and distinct from an empyema of the sinus. However, in the case of an acute inflammation of the maxillary sinus, swelling and pain are frequently the symptoms of perforation of its wall by necrosis of the bone or by the pus following along the venæ perforantes, gaining access to the soft tissues of the cheek.

Dilatation of the maxillary sinus is rarely occasioned by puru-

lent inflammation, but is much more frequently due to alveolar or maxillary cysts, mucocele, or cystocele of the antrum itself, or to neoplasms. It is highly improbable that dilatation of the maxillary sinus ever takes place from inflammatory disease. However, it is quite possible that the nasal wall of the maxillary antrum may be pressed outward by an accumulation of pus within its cavity. Especially is this true of the membranous portion of this wall, namely, in the middle meatus in the region of the ostium. Hartman reports such cases, and Zuckerkandl has observed dead bodies in which the pars membrosa was quite convex toward the nose, resembling a tumor in the middle meatus. In a case of very acute empyema Hajek opened such a projection in the middle meatus by means of a probe and thus let out the accumulated secretion.

*Diagnosis.*—The diagnosis of empyema of the maxillary sinus can be made invariably by two methods: (1) Aspiration or irrigation of the maxillary antrum, and (2) transillumination; or we might say by means of transillumination, and then by irrigation of the antrum, in case we obtain a positive result by the former procedure. Aspiration alone is not sufficient, as the secretion may be too small in amount or too thick to pass through the aspirating needle. We may irrigate the maxillary antrum through a natural opening; that is, through the ostium or an accessory opening, or by means of an artificially produced opening. In relatively few cases can the disease be reached through the ostium or natural opening (probably one in ten). However, it should be an invariable practice to attempt irrigation through a natural opening before surgical puncture is adopted.

The maxillary ostium or an accessory opening is reached by means of Hartman's or Moritz Schmidt's cannula. Failing this, we may make an exploratory opening through the inferior or middle meatus, through the canine fossa, or through the alveolar process. Surely a tooth or teeth should never be sacrificed in this procedure unless there is indubitable evidence of the empyema being of dental origin. The most satisfactory results follow perforation of the inferior meatus. For this purpose I am in the habit of using either Myles's trocar or Moritz Schmidt's syringe. In case the Moritz Schmidt syringe is used in aspirating and there is failure to find pus, the irrigator is placed in the barrel of the syringe and the cavity is washed out, the fluid finding its exit through the ostium

maxillare. Exploratory puncture has nearly always been made in the inferior meatus, about three-quarters of an inch from the anterior end of the inferior turbinate body. If we fail to penetrate the antrum on account of the thickness of the bony wall or because the antrum is situated above the floor of the nose, we may penetrate the nasal wall in the middle meatus posterior to the processus uncinatus. However, it is very rarely necessary to choose any place other than the inferior meatus. Out of 300 exploratory punctures at this point, only two failed. It goes without saying that it is absolutely necessary to remove all secretion from the nose before the antrum is irrigated.

A word must be said in regard to the superiority of aspiration over irrigation in certain cases. In those cases in which the secretion is serous in character, the serous fluid may be lost sight of in the irrigating fluid. Therefore, aspiration should precede irrigation. It is very embarrassing in cases in which other symptoms point to empyema of the maxillary sinus to get no pus on aspiration. This may be due to the needle penetrating between the bone and muco-periosteum of the antrum or to the end of the needle entering the anterior or lateral wall of the antrum, or to a fold of mucous membrane within the antrum stopping up the hole in the cannula, or to the presence of thick, tenacious, or cheesy material. Only in the most exceptional cases is the antrum divided into an anterior and posterior chamber by a longitudinal bony septum. In case any of these accidents occur, it is best at once to withdraw the needle and to try another puncture, either in the same or in an entirely different direction.

In making the puncture it is well, as soon as the needle perforates the wall of the antrum, to turn its point upward. In this way we obviate the danger of getting beneath the muco-periosteum, or under the folds of mucous membrane on the floor of the antrum. It is difficult to see how an operator in attempting to puncture the wall of the antrum should pass through its cavity into and even through the anterior or lateral wall; yet such accidents have occurred, with the result that the soft tissues of the cheek have been infected, resulting in the formation of an abscess, attended for several days with fever, chills, etc.

Transillumination was first used by Heyring for the diagnosis of empyema of the maxillary sinus, and is carried out in a thor-



oughly darkened room. An electric lamp is placed in the mouth, held firmly between the teeth by the patient, the lips being closed tightly around the handle of the lamp. Before doing this we should see that the patient does not have an artificial plate, gum, or tobacco in the mouth. After turning on the light, a rosy glow is found outlining the lower portion of the face, and is especially marked in the infra-orbital region. In the pupils there is also a glimmer of the transilluminating light. In empyema of the maxillary antrum one side of the face remains dark, or, at least, there is an infra-orbital shadow. The value of transillumination is estimated differently by different observers. A positive result may surely be had in affections other than empyema, such, for instance, as asymmetry in the bones of the face, small antra, polyps, or hypertrophies within the nose, etc. According to Lichtwitz, the shadow may remain equally dark after complete emptying of the purulent antrum; I have made the same observation. This is due to the hyperemia, infiltration, or thickening of the muco-periosteum. While it is not considered of great value in the diagnosis between collections of serous fluid, maxillary cyst, tuberculosis, osteomyelitis, or tumors of the maxillary antrum, it is a diagnostic measure of great worth, and will never be dropped from modern methods of diagnosis.

#### FRONTAL SINUS

In frontal sinus disease, headache (which may be unbearable) or neuralgic symptoms are more prominent and appear more frequently than in inflammation of any of the other sinuses, with the exception, perhaps, of the anterior ethmoidal cells. A peculiarity of the pain is that it begins on arising in the morning, a fact explicable by the position of the ostium frontale becoming dependent when the individual assumes the upright position. When in a horizontal position, the pressure of the secretions within the frontal sinus is removed from the ostium. Discharge of pus is much less, as a rule, than in inflammation of the maxillary antrum, but more continuous or less intermittent. Loss of smell and taste are perhaps more often present in frontal sinus disease than in antral trouble. On examination, pus is found coming from the region of the forward portion of the infundibulum. About this region there are atypical hypertrophies which possess the same general characteristics as atypical hypertrophies about the ostium maxillare.

When empyemas of one of the other sinuses have existed for some time, pain on pressure or on tapping the frontal region is usually complained of. The position of atypical hypertrophies in acute cases or acute exacerbations of chronic cases has this significance, as the entire middle meatus may be filled with them or true polyps. Occasionally we find edema over the anterior wall of the frontal sinus, and this may extend to the upper eyelid. Not infrequently the ductus frontalis may become entirely obliterated and fistulas form which may lead anteriorly into the supra-orbital region, inferiorly into the orbit or into the nose.

*Diagnosis.*—In the diagnosis in every case of suspected frontal sinus disease we should endeavor, first, to sound the frontal sinus through its natural opening. Only when this is accomplished and pus is seen flowing down the probe in increasing quantities may we be sure of empyema of the cavity. Having done this, we should proceed with irrigation. Probably in much less than one-half of the cases can we pass a probe from the nose to the frontal sinus. Hypertrophy or extreme involution of the anterior end of the middle turbinated body, polyps, pronounced deviation of the nasal septum, or large bullæ, may prove hindrances to successful probing. Indeed, it may be necessary and best to remove at once the anterior end of the middle turbinate body in order to gain access to the sinus.

As to the method of sounding the sinuses—a delicate silver probe is curved about fifty degrees for about two centimeters from its distal end. The end is then passed in the middle meatus under the anterior portion of the middle turbinate body and made to travel upward and forward and somewhat outward. When there is atrophy of the middle turbinated body or when it has been removed, we may occasionally pass a probe that is straight or only slightly bent directly into the naso-frontal duct. If a probe can be passed and the direction of the naso-frontal duct found, we may then pass a delicate cannula in the same direction; this may be attached to a syringe or reservoir containing an antiseptic solution, and the contents of the sinus washed out. The use of the fluoroscope aids us in determining the passage of the probe or cannula into the frontal sinus.

The use of transillumination in frontal sinus disease is of less diagnostic value than in maxillary sinus disease. It is not valueless,

however, especially when we use a light of very high power, such as the one recently produced by Dr. Jackson, of Pittsburg. The light is covered with an opaque substance, rubber or fiber, except at its distal end. The lamp is then pressed into the inner infra-orbital region, and the two sides compared.

Hypertrophy of the promontory and the septum occurs in disease of the frontal, as well as in disease of the ethmoid, cells.

#### ETHMOID CELLS

The general symptoms of acute or chronic empyema of the anterior or posterior ethmoid cells have little or nothing to distinguish them from those occurring in the course of inflammation of the frontal sinus. The headache is, however, not so severe, as a rule, and the neuralgic symptoms are rarely present. The discharge is usually less, but it may be very great in amount. Usually the patients complain of a dull, heavy sensation back of the bridge of the nose, especially in acute cases or in the course of acute exacerbations. The discharge from the ethmoid cells has a special tendency to form scabs along the anterior portion of the middle meatus, but the diagnosis of ethmoid disease depends on rhinoscopic examination.

Clinically, empyemas of the ethmoid cells are divided into obscure and manifest forms; and circumscribed (single) or diffuse (plural) forms; that is, those in which one or more cells are affected. It may be a closed or open empyema. In the open variety the secretions are emptied constantly into the nose either through their natural openings or through ruptures of their walls; in the closed (or occult) variety the secretion is retained, and by its pressure on the walls of the cells sooner or later leads to their dilatation. This variety is again divided into relative and absolute, temporary and constant empyema. A relative empyema is one in which the secretion is with difficulty discharged because of the presence of polyps, infiltration, or swelling about the mouths of the ducts, there being always more or less retention of secretion. An absolutely closed empyema is one in which, through swelling or obliteration of the duct, there is complete retention. A temporarily closed empyema is one in which through exacerbation of the inflammation the ducts become completely closed, and the secretions which usually flow into the nose are completely retained. A constantly closed

empyema is one in which from the first the secretion has been retained. The empyemas of the ethmoidal labyrinth which break into the orbit are frequently of the latter varieties.

*Latent or Closed Empyema.*—Under this division fall those cases which present on rhinoscopic examination circumscribed, tumor-like prominences, in relation to or actually of the middle turbinate body itself. Their contents may be serous (mucocoele) or seropurulent, or entirely purulent, according to the degree of bacterial infection. They may occupy: (a) The middle turbinate body,—when, on anterior rhinoscopy, we see a larger or smaller, circumscribed tumor occupying more or less of the concha, touching, it may be, the septum and overhanging the inferior turbinated body. (b) The middle turbinate body, and produce a more diffuse swelling of its free border. (c) The bulla ethmoidalis. If this bulla is greatly dilated, it may push the middle turbinate upward, so that on rhinoscopy we mistake the former for the latter. When the bulla is but slightly ectatic, we may be misled into believing that no empyema exists; or a very large bulla may be normal. If it is not the result of ectasis its covering of mucosa is healthy and a bulla of like size is present on the opposite side if normal. In case a small bulla is the seat of empyema, polyps or hypertrophies are perhaps always present. The differential diagnosis from polyps or hypertrophies is easily made with the sound. Their contents is ascertained by puncture with a drill, trephine, or sharp spoon.

*Open Empyema.*—In this group occur the greater number of cases which show on rhinoscopic examination purulent secretions, accompanied by scabs in and about the middle meatus. While, as has already been said, the quantity of secretion found in this region gives no conclusive data on which to base an opinion as to which of the accessory sinuses it is extruded from, experience teaches that when such secretion displays a pronounced tendency to form scabs, it is found to originate in a large majority of cases in the ethmoidal labyrinth. These scabs should, therefore, be carefully removed by means of forceps or pledgets of cotton, whereupon the underlying pus may lead us directly to the cell or cells where it originates. In view of this valuable means of locating the origin of the suppuration, it goes without saying that a rhinoscopic examination should never be preceded by the nasal douche. In other cases the origin

of the purulent material may become manifest only after the removal of polyps, hypertrophies, or the degenerated middle concha itself. After the removal of the turbinate body, the typical opening between the bulla and the place of attachment of the concha may be sounded. Only by exclusion may we differentiate between empyema of the maxillary antrum and empyema of the anterior ethmoidal cells when the secretion comes from those ethmoidal ducts emptying into the infundibulum. Irrigation of the maxillary antrum may exclude suppuration here. However, it must be remembered that in over 50 per cent. of the cases more than one accessory sinus is affected simultaneously. Those who have had a large rhinologic experience will agree with me when I say there are cases of ethmoidal empyema which tax our diagnostic methods to the last degree. In cases, for instance, in which the middle concha is strongly involuted, rendering the middle meatus inaccessible to sight, such a turbinal may present all the appearances of health. In such a case the secretions may be entirely emptied posteriorly, causing those scabs in the vault of the pharynx which are so annoying both to the patient and to the physician. In Hajek's opinion, the localized hyperemia and increased sensitiveness to pressure of such a middle turbinated body, as compared with the one on the healthy side, is of diagnostic significance in suspected cases. Ethmoidal empyema which invades the orbit will be dismissed with a few words. The fistulas, most frequently found in the inner angle of the eye, lead to a defect in the lamina papyracea. Cases which have not broken externally may be differentiated from the so-called idiopathic orbital abscesses by rhinoscopic examination.

#### SPHENOIDAL SINUS

The subjective symptoms accompanying empyema of the sphenoidal sinus are as inconstant and as non-pathognomonic as empyemas of other sinuses. We must depend for our diagnosis on anterior and posterior rhinoscopy, and the position of the secretion is the first thing to look for. Only rarely are we able to observe the ostium of the sphenoidal sinus by anterior rhinoscopy. Occasionally, however, in cases in which the fissura olfactoria is wide, we may observe the purulent secretion coming directly from the ostium, in which case the diagnosis is at once complete. In other cases, the natural

configuration of the middle turbinate body or pathologic change therein, or deviations or spurs of the septum, obstruct our view.

Adrenalin and cocain should always be employed in examining for all sinus diseases. Killien's intranasal speculum is an aid in overcoming a certain number of these obstructions. Indeed, the middle concha is susceptible of quite a degree of movement by pressure of its blades. When there are hypertrophies, these must be removed, or the entire middle turbinated body may have to be excised, if it is sufficiently diseased, or if there is evidence of sphenoidal empyema. The presence of scabs and mucopurulent secretion in the postnasal space, in the olfactory fissure, and in the recessus sphenothmoidalis, should always arouse suspicion of empyema of the sphenoidal sinus. These secretions and scabs may be due to disease of the local mucosa or they may originate in the sinus. In the latter event the scab is more likely to be accompanied by purulent secretion in greater or less amount, and such secretion may be traced directly to the neighborhood of the sphenoidal ostium, or it may be seen to cover the posterior ends of the middle turbinate body, or to occupy the posterior portion of the olfactory fissure. When such a picture is presented at several successive examinations, we may be fairly certain of the existence of an empyema of the sphenoidal antrum or of the posterior ethmoidal cells. There is always granulation tissue or polypoid growths, either on the septal or on the conchal side of the olfactory fissure when the empyema is chronic.

*Diagnosis.*—The differential diagnosis between empyema of these posterior ethmoid cells and of the sphenoidal sinus is extremely difficult and often impossible in many cases. Only when these obstructions to view are removed may an exact diagnosis in many cases be made. The middle turbinated body is most frequently the obstruction which prevents us from seeing both the ostium sphenoidalis and the opening of the posterior ethmoidal cells in the superior meatus. Hajek says that the sphenoidal antrum, like the maxillary, often serves only as a reservoir for the discharge from other cavities; at least, he apparently proved this in two cases in which the middle turbinated body had been removed. As long as the ostium sphenoidalis was plugged, its cavity remained free from secretions. When the plug was removed at night, the cavity was found filled with the secretion that came from the posterior ethmoid cells.

We may probe the sphenoidal sinus through its natural opening, as in the majority of cases this procedure is carried on without the aid of sight. Zuckerkandl made the rule from observations on the dead body and on the living that the ostium sphenoidalis lies at the end of a line which begins at the inferior nasal spine and traverses the center of the middle turbinated body. The anterior wall of the sphenoid antrum may be broken down with a bur or sharp spoon for diagnostic purposes. But all surgical procedures in this region should be conducted with due care of the neighboring great vessels and nerves—the carotid, the optic nerve, and the hypophysis being separated from the interior of the sinus by thin bone, or in occasional cases by membrane alone.

I shall call attention to only one complication of sphenoidal empyema, the extension of the inflammatory process to the orbit. When this occurs, the infection causes abscess of the orbit. The symptom-complex of sudden blindness and exophthalmos is typical. From the orbit the ophthalmic vein may become thrombosed, which thrombosis extends to the cavernous sinus, with accompanying meningitis.

# Physiology

## SOME PHYSIOLOGIC ASPECTS OF EHRLICH'S SIDE-CHAIN THEORY, AND ITS APPLICATION TO THE PHYSIOLOGY OF DIGESTION<sup>1</sup>

BY JOHN C. HEMMETER, M.D., PHIL.D.

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IN the so-called side-chain theory of immunity by Ehrlich, we find the most ambitious introduction of chemical conceptions. Long before Ehrlich, Pasteur introduced the notion of molecular asymmetry into chemical science and called attention to the importance of the conception of configuration in dealing with certain chemical problems.

In 1894, during an investigation of far-reaching importance on the bodies of the sugar group, Emil Fischer made some remarkable statements on the behavior of certain enzymes in the fermentation of sugars. He pointed out that in order to work as ferments, the enzymes must possess a certain stereo-chemical structure bearing a certain definite relation to the stereo-chemical structure of the sugar. Without this relation fermentation cannot take place. In order to make his meaning plain, Emil Fischer employed a figure which has since become famous. In speaking of certain glucosides, he said, "Enzyme and glucoside must fit into each other as a key into a lock in order that the one may be able to exert a chemical action on the other." Furthermore, Fischer suggested that the idea of related molecular configuration of enzyme and fermentable body may prove of value in physiologic investigation as well as in chemistry.

Apparently we have in this prediction of Fischer, made 11 years ago, the basis of Ehrlich's hypothesis, and the often quoted symbolic analogy used by Ehrlich: "*Wie ein Schlüssel in das Schloss*" is an expression borrowed from Emil Fischer.

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<sup>1</sup> Received for publication, January 28, 1905.



The opinion that the antibodies are themselves enzymes is erroneous; because the antibodies do not act upon the invading toxins (ferments, bacteria) according to the type of a ferment. These invading substances (toxins, etc.) are not split up or oxidized; no hydrolysis takes place as occurs under ferment action; furthermore, the antibodies are consumed or used up, which does not occur with enzymes. Enzymes do not appear in the endproduct of the catalysis, but the antibodies unite directly and combine with the toxin. Antibody does not act upon toxin like pepsin upon albumin, but like an acid upon a base.<sup>1</sup>

This conception, if true, brings the solution of problems of the chemical nature of antibodies within the range of probability, for if it could be definitely proved that they are enzymes they would, like all enzymes, escape the stoichiometric analysis of the chemist; at least, up to the present time there is no way of ascertaining the exact chemic composition of enzymes.

Ehrlich attributes antitoxin production to the cells that are especially sensitive to any poison; for example, in cases of tetanus toxin the antitoxin he supposes is produced by the nerve-cells. Gruber and Vaillon oppose this view. The ease with which a group of cells can be poisoned must not be confounded with avidity for that particular poison. Grassberger and Schattenfroh, Gruber, and others have shown that under a definite poison certain organs whilst showing a sufficiently great avidity to the poison are not irreparably or only slightly damaged, and other organs (on the other hand) possessing only a very slight avidity for the same poison suffer severely. Avidity is here identical with chemic affinity.

Toxin, according to Ehrlich, is a kind of spoiled, disintegrated protoplasm (cytoplasm or bacterioplasm, as the case may be). If we assume this we can understand how cells may be very sensitive to a toxin and yet not have an avidity for it; they cannot catch or take it up. For example, nerve-cells are highly sensitive to the catabolic products or results of broken-down protoplasm, but physiology forbids us to assume that nerve-cells are actively concerned in assimilating and taking up such catabolic products (*Abbauprodukte* of Gruber).

This toxin assimilation and transformation may be a property

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<sup>1</sup> Jacoby, *Ergebnisse der Physiologie*, 1. Jahrg., I. Abtheil., S. 244.

of such cells and organs (closely related genetically to the intestinal tissue) that have had much skill in neutralizing and metamorphosing abnormal substances (gland cells). According to Ehrlich, the antitoxins are important constituents of the architecture of protoplasm; many facts support this view; for example, the injection of antitoxin causes no formation of antibodies.

We should not be surprised if the higher differentiated cells (nerve-cells) should have a great avidity for toxins. On the other hand, the production of antitoxin may be a function of a lower order of cells (gland cells). We must distinguish between sensitiveness to toxin poison (*Vergiftbarkeit*) and avidity (chemic affinity) for poison. Ehrlich attributes the production of antitoxin (tetanus) to cells that are most sensitive to this toxin (nerve-cells) (nerve-cell damage objectively is the one most readily noticeable by the observer). Now hens are extremely sensitive to direct cerebral applications of tetanus toxin, but on intravenous injection of this poison in large quantities they form large quantities of antitoxin *without being damaged in their nervous system*. If the production of antibodies was a rôle of the "sensitive" cells pre-eminently and exclusively, this would be a puzzle.

We must in this difficulty distinguish between (1) chemical detrimental influences on highly differentiated cells that are readily poisoned (very sensitive), but produce no antitoxin, and (2) detrimental influences on cells not so sensitive (not easily poisoned), but producing the antitoxins.

Ehrlich's theory that the antitoxin is formed by the cells most sensitive to the poison is somewhat difficult to comprehend, because it ascribes a very laborious task, complicated chemic work, to cells most readily poisoned, that is, injured, and not to cells comparatively freer from the poisoning influence.

The most widely accepted view is that saturated toxin and antitoxin combinations (neutral mixtures) are indifferent for the normal organism—only the full, unbound toxin (dissociated toxin) of the mixture, can have an effect in causing the production of antibodies. Grassberger and Schattenfroh give the experimental evidence that immunization of animals can be accomplished at one operation, that is, active immunization, with the production of demonstrable antitoxin in the blood, by neutral and overneutral mix-

tures.<sup>2</sup> In other words, toxin-antitoxin mixtures that were saturated with antitoxins were *not* indifferent for the animal body. Here we must attribute the immunization to the toxin-antitoxin combination. There are two possibilities here, (1) the ability to cause the production of antitoxin must be assigned to the toxin-antitoxin combination *as such*, by virtue of its content of implicated or combined toxin, or (2) we must accept an extensive dissociation of the substances implicated in the mixture, when the latter reaches the organism, each of the dissociated groups entering into effect, that is, the freed toxin leading to the production of antitoxin in the organs capable of producing it, whilst at the same time the freed antitoxin protects the cells sensitive to the toxin. It is conceivable that the complex toxin-antitoxin molecule still has affinities for the organs that are capable of producing antitoxin, whilst the avidity of the toxin-sensitive cells is reduced or lost.

The greatest difficulties are met in attempting to explain the active immunization of oxen and heifers by supersaturated serum mixtures (Ueberserum Gemische), that is, mixtures the toxic affinities of which have been completely saturated in glass vessels and that liberate no dissociable toxin on being heated.

The consumption of antitoxin by the (vergiftbare) cells having a great avidity therefore may keep step with the production of antitoxin by the cells capable of producing it, and in that case then it would not be possible to demonstrate much antitoxin in the blood.

In an address on the relations between chemical constitution, distribution, and pharmacologic action, Ehrlich has emphasized the great significance of the peculiarities in chemic constitution of elements foreign to the organism, that is, as far as their distribution in the various cells and their differing effects are concerned.

Löw had defended the view that these foreign elements, for instance, narcotics, antipyretics, pigments, actually enter into real syntheses with the living protoplasm; in other words, that they conduct themselves like the assimilable food substances. This view is energetically refuted by Ehrlich,<sup>3</sup> for two reasons: (1) These foreign substances are very easily extracted from animal tissues,

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<sup>2</sup> Beziehung v. Toxin u. Antitoxin, Grassberger u. Schattenfroh, Hygien Instit., Univ. Wien, February, 1904.

<sup>3</sup> Von Leyden, Festschrift, I. Bd., also Gesam. Arbeiten zur Immunitätsforschung, p. 607.

and (2) he had never observed pigment changes, that is, staining reactions occur on injection of suitable basic dyes or stains into the *living organism*, although these color changes occur so readily *outside* of the living body when the amido groups are replaced by aldehyde radical. If the coloring substances actually entered the protoplasm molecule in a substituting manner, such permanent changes by pigments exerted in the living body ought to have been occasionally observed in the exceedingly large number of experiments hitherto made. But the substances capable of assimilation, which represent the specific nutritive substances of protoplasm, enter into a very firm combination with protoplasm, from which they can only be split off by very energetic means,—boiling with acids, for example.

The injection of ordinary food-stuffs, for instance, the various albuminous and proteid substances, causes in the organism the production of very specific antibodies (coagulines, precipitines). Upon this fact Ehrlich assumes that in the process of the assimilation of food substances a similar combination of the food molecule with the receptors of the protoplasmic molecule takes place, as occurs during the combination with toxins.

But whilst the toxin is relatively simple in structure (compared with the food substance) and the toxic effect of its toxophore group can be readily transferred to the molecule of protoplasm by its receptor, the albuminous or proteid nutritive substances, however, are very complex in chemic structure, which must be more and more disintegrated before they can be made useful to the protoplasm.

According to the symbolism of Ehrlich, this is best accomplished when the receptor that anchors the albumin molecule to the protoplasm has at the same time an enzyme-like group which attends to the further molecular disintegration of the giant molecule of albumin.

The receptor for the toxins has only one single haptophor group which unites with the haptophor group of the toxin, but the receptor for the nutritive albumin molecule has two groups, first a haptophore group which anchors down the albumin molecule, and, second, a zymophore group which effects the fermentative disintegration of the albumin molecule. Those of the first kind, namely, which act as receptors for toxins, Ehrlich designates as "*Receptors of the first order*" (Rezeptoren I Ordnung). Those of the second

kind he designates "receptors of the second order" (Rezeptoren II Ordnung). Still more complicated are his Rezeptoren III Ordnung,

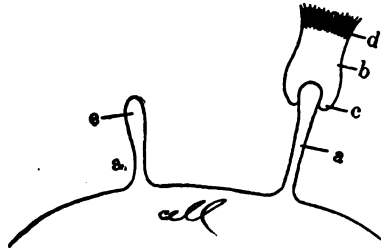


FIG. 1.—Receptor of first order. *e*, haptophor complex; *b*, attracted toxin molecule, with haptophor, *c*, and toxophor group, *d*.

which effect the anchoring down of complex bodies resulting from disintegration of bacteria and animal cells,—bodies which after their

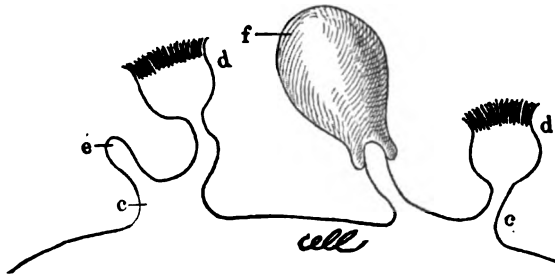


FIG. 2.—Receptor of second order. *e*, haptophor group; *d*, zymophor group; *f*, a molecule of nutritive substance that has been attracted.

liberation circulate in the blood as "Hemolysins," "Bacteriolysins," and "Cytolysins."

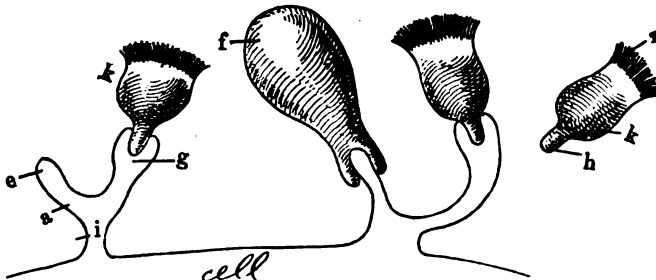


FIG. 3.—Receptor of third order. *e*, haptophor group; *g*, complementophile group; *k*, complement with, *h*, haptophor group, and, *z*, zymotoxic group; *f*, molecule of nutritive substance that has been attracted.

In the action of these lysins two substances must work together,—the "immune body" (which, by the way, has seven different des-

ignations by different investigators) and the complement. The "immune body" liberated into circulating blood corresponds to the receptor when it is attached to the protoplasm molecule. The immune body (amboceptor) must be built up like the receptor, that is, the immune body must contain a haptophor group which attends to the anchoring down of complex disintegration products of bacteria—red blood-corpuscles, etc., and a second group, which, however, does not by itself act as an enzyme, as it does in the "receptors of the II order," but is conceived as only having the ability to attract to itself ferment-like bodies circulating in the blood, the so-called "*complements*." Only after this has occurred can the anchored-down substance undergo further disintegration and utilization.

The functions of these three different kinds of receptors is conceived as occurring in different manners. For, whilst the super-regenerated and liberated receptors of the first order destroy the effect of the toxins by simple and direct combination with them, the receptors of the second order, that is, the coagulins, agglutinins, and precipitins, after their combination with the nutritive albuminous substances, can produce coagulation, precipitates, and agglutinations immediately and directly by means of the zymophor group that belongs to them. The receptors of the third order, however, are ineffective, although liberated into the blood, even after their connection with the cells that were utilized for their production. They are ineffective until the complements, which are present normally in the blood, have united with the receptors belonging to the cell and exerted their ferment-like action.

These different receptors bring about the anchoring down of the ordinary food substances as well as of the toxins and the disintegrated products of bacteria and cell. As long as the receptors are in the living protoplasm molecule of the cell and are uncombined, their action is to attract these substances, useful as well as harmful. But as soon as they are liberated into the blood by super-regeneration, they detract from the protoplasm molecules of the cell, because they already unite in the blood with the substances named, and thus they protect the cells from their effects. In case of toxins and disintegrated parts of bacteria and cells, these effects would be deleterious and harmful; in case of nutritive albuminous substances, these effects would be beneficial.

It was in his extension of his "side-chain" theory to the normal physiologic cell nutrition that Ehrlich met with difficulties. For he could not exclude that receptors in excess were formed and liberated into the blood. Now if receptors circulating freely in the blood are conceived as protecting the cell from toxins and products of disintegrated metabolism by uniting with these deleterious substances in the blood, we must admit the same possibility as occurring between freely circulating receptors and the food substances, which, however, in this case, when receptors unite with food substances in the blood, do not protect the cell, but rob it of its nutrition. The liberated receptors, when circulating in the blood, Ehrlich designates as "haptins." To the haptins of the first order belong the antitoxins and the ferments; to the haptins of the second order belong the agglutins, coagulins, and precipitins; to the haptins of the third order belong the cytolytins, hemolytins, and bacteriolysins. It was these haptins of the third order, when generated in excess and circulating freely in the blood, that gave the difficulty in explaining the application of the side-chain theory to physiologic cell nutrition. Nutrition of the cell is impossible if the haptins already unite with the nutritive substances in the circulating blood, and prevent the nutritive substances from reaching the cells. Ludwig Aschoff has attempted to explain away this difficulty by asserting that a great part of these haptins were removed from the body through the secretions, that another part was consumed in the disintegration of the nutritive substances in the blood, and that the introduced food substances are present in such great amounts that there is always an excess present for the nutrition of the cell. To these explanations of Aschoff we might reply that it is not quite intelligible why the haptins of the first and second order, those that neutralize toxins in the blood, and disintegrated products of bacteria and cellular protoplasm, should not also be removed from the body in the secretions, when there is need for them caused by the presence of substances with which they could combine in the blood. The second explanation of Aschoff that the food substances are present in such excessive amounts that there is always an excess left over for the nutrition of the cell, may also, if applied to the haptins of the first order, be conceived as working a damage to the cell, for if the haptins of the first order are not

present in sufficient quantity the toxin molecules will combine with the protoplasm molecules of the cell, and cause its destruction.

From this it is evident that the application of the side-chain theory to processes of normal cell nutrition and assimilation, although interesting and feasible, is not yet practical nor based on objective experimental evidence. But as Ehrlich has shown, inasmuch as the substances gained artificially by means of immunization are nothing else but the tools of normal cell life which have been separated by the immunizing process from the locality of formation and isolated, it is probable that the physiologic processes of secretion and assimilation can be profitably studied from the stand-point of Ehrlich's theory. Furthermore, it is conceivable that conditions like malnutrition, without demonstrable organic disease, and some of the forms of obesity or hypernutrition, could be profitably studied from the same stand-point.

#### THE ACTION OF DIGESTIVE FERMENTS VIEWED FROM THE STAND-POINT OF EHRLICH'S SIDE-CHAIN THEORY

From the discovery of Delezenne we know that fresh extract of pancreatic gland can exert no digestive action on proteid by itself alone.<sup>4</sup> But if a small amount of succus entericus is added to pancreatic extract, tryptic digestion at once begins. The succus entericus contains enterokinase (Pawlow and Chepowalnikoff). Enterokinase can very easily be gained by permitting fibrin to remain a certain time suspended in succus entericus. It then becomes attached to the fibrin. If the fibrin thus charged with enterokinase is brought together with pancreatic juice at 0°, no tryptic effect occurs, but it does occur when the mixture is brought into the incubator. These observations suggest that the enterokinase, which in itself is ineffective, acts as an amboceptor, chaining the trypsin to the fibrin. Delezenne showed that the enterokinase of the dog could act as an amboceptor for the trypsin of animals of different species. Enterokinase, it is true, is not so resistant to heat as the amboceptors of hemolysis.

Bayliss and Starling consider that the secretion of pancreatic juice is not reflex, as was originally held by Popielski and Wertheimer, but that it is due to an exciting substance which is pro-

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<sup>4</sup> Compt. rend. de la Soc. de Biol., Paris, Dec. 28, 1901, p. 1161.



duced in the intestinal mucous membrane under the influence of the acid gastric juice. If the mucosa of the jejunum and duodenum is exposed to the action of a 0.4 per cent. HCl, a body is produced which when injected into the blood-stream in minimal doses produces a copious secretion of pancreatic juice. This substance they term *secretin*, and it is associated with another substance which lowers arterial blood-pressure. This secretin is, of course, not identical with enterokinase, for secretin is an inorganic substance, not an enzyme, and it is not specific to different kinds of animals, but is the same substance in all animals. Secretin is not destroyed by boiling. Whilst it sets up the secretion of pancreatic juice by way of the circulation, it does not activate pancreatic juice for proteids like enterokinase does. The accelerating action which enterokinase is claimed to exert upon trypsin digestion, according to Pawlow, has received another interpretation by the discovery of Otto Cohnheim.<sup>5</sup> Hofmeister, Salvioli, and Neumeister had observed the disappearance of peptones when they came in contact with intestinal mucosa, and they interpreted this as a restitution of the peptones into native albumin by some power inherent in the mucosa. This is denied by Cohnheim, who has discovered a new enzyme formed in the intestinal mucosa, which he terms *erepsin*, and which has no effect on fibrin and ordinary proteids, but acts only on peptones and a part of the albumoses, converting them into simpler compounds; and S. Ssalaskin discovered that this erepsin is a normal constituent of the succus entericus.<sup>6</sup> Concerning the relative functions of enterokinase (of Pawlow) and erepsin, no clear conceptions can as yet be formulated. According to the view of some physiologists, these two substances may be identical. According to others the enterokinase acts simply as an amboceptor for the trypsin. According to Ehrlich's theory, this enterokinase ferment, in order to do the work that it is known to be able to accomplish, would have to have a very complicated structure, that is, one haptophore group for the albuminous body, a second haptophore group for the trypsin, and, thirdly, an additional zymophore group, which, however, does not go into effect until after the trypsin has been anchored down. These conceptions started from the experiments and suggestions of Fischer, which I have represented at the

<sup>5</sup> Hoppe-Seyler's Zeitschr. f. physiolog. Chemie, Bd. 33, Hft. 5 and 6, S. 451.

<sup>6</sup> Russaki, Archiv. path. klin. Medic. i. Bacteriol., Bd. xiv, p. 3, Sept., 1902.

beginning of this report,<sup>7</sup> and were later on extended and applied to all fermentative processes in the light of Ehrlich's theory, namely, that simple ferments, like the chymosin or rennet, are supplied with a specific haptophor and with a more generally active toxophor or zymophor group. This conception is analogous to that of toxins. The enterokinase he conceives as amboceptor.<sup>8</sup> Just as the action of toxic alkaloids differs from that of bacterial poisons only by the nature of their combination with the thing to be acted upon, so also with the ferments. If the zymophor group is once tied down to the fermentable substratum, it acts simply as a catalyzing substance, like dilute acids. The specific fermentative force would be then attached to the haptophor group, and the force that acts catalytically upon the most widely different bodies would be tied down to the zymophor group of the ferments. These applications of the Fischer and Ehrlich conceptions (narrated at the beginning of this article) are made by Oppenheimer, and were no doubt inspired by an article by G. Bredig.<sup>9</sup> The main points in the conception are the action of two different groups in organic ferments, and their specificity. But there are many difficulties standing in the way of a general application of the Fischer-Ehrlich hypothesis to the action of all ferments. It requires a tremendous effort of the imagination to conceive that the very simple fermentable bodies like amygdalin and cane-sugar should have specific haptophor groups for the yeast ferment, and although antibodies have been experimentally produced against chymozin (rennet), all efforts to find anti-diastrases and anti-pepsin, etc., have been without result. Martin Jacobi<sup>10</sup> also cautions against the identification of toxin action with fermentative processes. Ferments are substances the actions and effects of which are to a great extent comparable to the catalyzers of inorganic chemistry.<sup>11</sup> They influence chemical transformations without taking part in the reaction or ap-

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<sup>7</sup> Oppenheimer. Zur Theorie der Fermentprocessor. Münch. med. Wochschr., 1901, No. 16, p. 624.

<sup>8</sup> See Oppenheimer.

<sup>9</sup> Die Elemente der chemischen Kinetik, mit besonderer Berücksichtigung der Katalyse und der Fermentwirkung, Ergebnisse der Physiologie, Jahrgang 1.

<sup>10</sup> Ergebnisse der Physiologie, Jahrgang 1.

<sup>11</sup> See Ueber Katalyse, by Wilhelm Ostwald, Leipzig, 1902; and Die chemische Organization der Zelle, by Hofmeister.

pearing in the end products. Toxins, on the other hand, are substances which are chemically combined within the organism. Toxins and antitoxins are much more resistant to various deleterious influences than the real ferments. In opposition to these facts, Oppenheimer<sup>12</sup> emphasizes that the action of ferments is not only catalytic, but he conceives that they are also changed during their action, and he even asserts that combinations of ferments occur with other bodies; for instance, that the enterokinase can be bound to the fibrin. To this I have to oppose that actual transformation of enzymes, whilst they are performing their characteristic reaction, has been by no means satisfactorily demonstrated. All that we know definitely in this connection is that the action of the organic enzymes is arrested by their own products, and by the presence of salts in excess of a certain percentage in the solution. This inhibition of enzyme action does not mean transformation of the enzyme; and, secondly, the fact that enterokinase can become attached to fibrin by no means proves that a chemical combination between the two exists. It may be simple mechanical attachment.

As long as there is no satisfactory explanation of the nature of enzyme action, nor even an accurate chemical analysis of a single enzyme, the application of the Ehrlich side-chain theory to the physiology of digestion is merely ingenious speculation. The conception which has the greatest probability in its favor is that the organic enzymes are catalyzers in a colloidal state. This is the view held by Professor Bredig. Newer investigations concerning the laws that control enzyme action have given no evidence that there are any principal differences in the nature of the actions between the organic enzymes and the catalyzers of inorganic chemistry.

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<sup>12</sup> Loc. cit.

# Pathology

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## THE ANATOMY, PHYSIOLOGY, AND PATHOLOGY OF THE CHROMAFFIN SYSTEM, WITH SPECIAL REFERENCE TO ADDISON'S DISEASE AND STATUS THYMICUS

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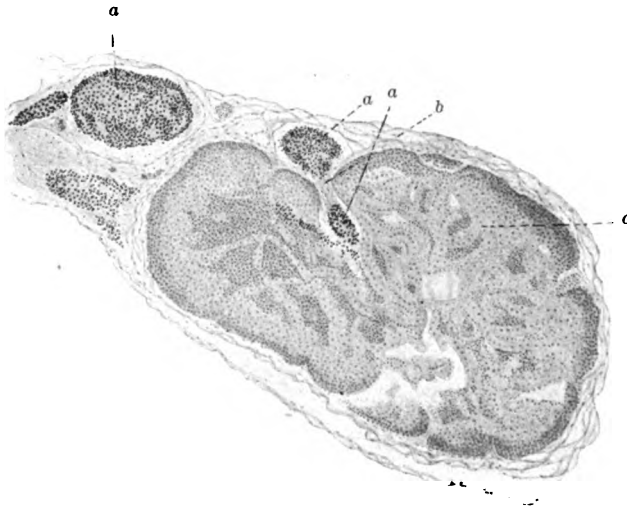
### ANATOMIC AND PHYSIOLOGIC INTRODUCTION

THE experiments of the last six years have added new and important facts to our knowledge of the anatomy, physiology, and pathology of the adrenal body and of the sympathetic nervous system. These are of importance not only on their own account, but also because of their interrelationship with the so-called chromaffin system. In order fully to understand this, a knowledge of the anatomy of the adrenal is essential.

As is well known the parenchyma of the adrenal is composed of two parts, the cortex and the medulla; these, while holding a topographic relationship to each other, are sharply differentiated embryologically, and, as I shall show in this communication, differ also in their physiologic and pathologic aspects. The cortex is composed of three zones, which I have shown to be identical morphologically and histogenetically, but which, on account of their histologic arrangement, are divided from without inward into the zona glomerulosa, zona fasciculata, and zona reticularis. Reference to the histology of the adrenal, which has been so often described, is unnecessary here; but I may point out that recently by using Unna's polychrome methylene blue, followed by differentiation in a 33 per cent. solution of tannin, I have demonstrated pictures that seem to



**FIG. 1.**—Immigration of the sympathetic formative cells into the adrenal cortex. *a*. Formative cells. *b*. Adrenal cortex. (10 mm. embryo of a pig; to be compared with 17 mm. human embryo.)



**FIG. 2.**—The connection by nerves of collections of sympathetic formative cells lying outside the adrenal cortex with others within the cortex. *a*. Formative cells of the sympathetic. *b*. Nerves. *c*. Zona fasciculata of the adrenal cortex. (20 mm. human embryo.)

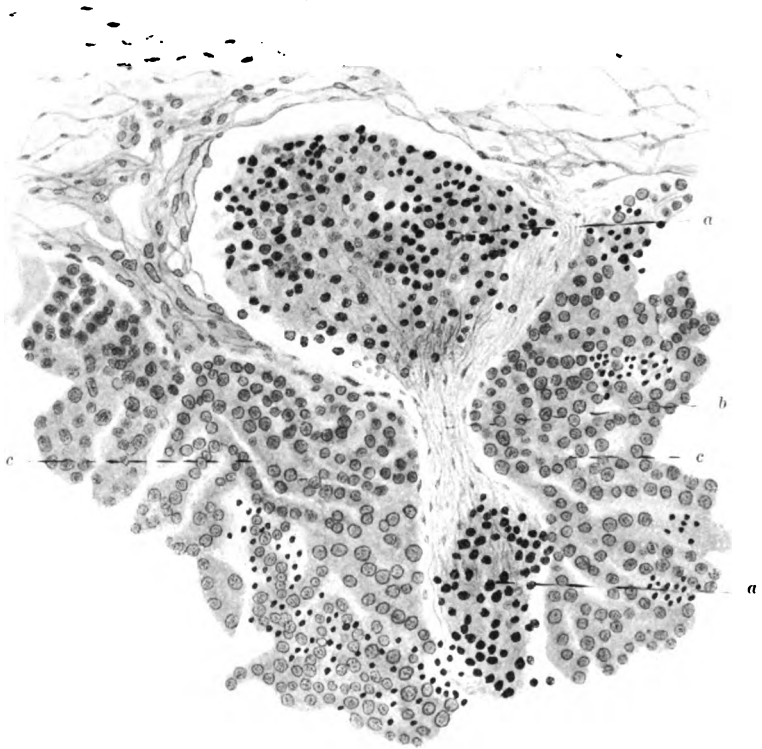


FIG. 3.—The connection by nerves of collections of sympathetic formative cells lying outside the adrenal cortex, with others within the cortex. *a*. Formative cells of the sympathetic. *b*. Nerves. *c*. Zone fasciculata of the adrenal cortex. (20 mm. human embryo.) (Same as Fig. 2, higher magnification.)

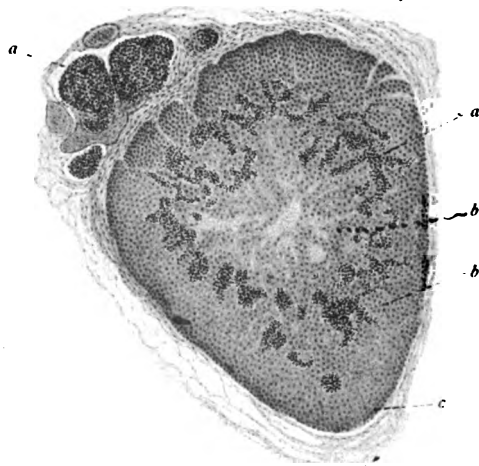


FIG. 4.—The arrangement of the sympathetic formative cells within the adrenal cortex and their advancing toward the center. (24 mm. human embryo.) *a*. Formative cells of the sympathetic. *b*. Zona fasciculata. *c*. Zona glomerulosa.

indicate functional differences in certain of the cells. In the zona fasciculata the nuclei of certain cells stain a brilliant red (Unna's acid nuclei), whereas others stain a blue (Unna's basic nuclei). Furthermore, certain cells give a typical mucin reaction (after staining with thionin, mucihematein, and mucicarmin). As regards the embryology of the adrenal cortex, I shall merely mention briefly that, as a result of certain experimental investigations, I have demonstrated (and Soulie has recently confirmed) that the cortex develops certainly from the celom-epithelium, that is, from the Wolffian body. At first it consists of a proliferation focus of undifferentiated cells of the celom-epithelium; the final formation is due to other factors, to which I shall refer presently.

The adrenal medulla consists of cells, irregular in shape, which stain an intense yellow or brownish color with salts of dichromic acid (potassium bichromate), whence they have been termed chromophile cells by Stilling, chromaffin cells by Kohn, and pheochrome cells by Poll. As a result of extensive studies of the development of the adrenal medulla of man and of the lower animals, I have ascertained the following facts: At an early period in the development of the embryo, certain detached cells (with well-staining nuclei and poorly staining protoplasm) are found in the principal trunk of the sympathetic system, which extends on both sides from the aorta toward the pelvis—the formative cells of the sympathetic. These cells multiply, and have at first no relationship with other organs. Resembling lymphoid cells and traceable throughout the whole course of the sympathetic, they are termed formative cells, because later the sympathetic ganglion cells and the entire chromaffin tissue, including the adrenal medulla, develop from them.

In an embryo of 17 mm. the cells representing the sympathetic nerve are in close contact with the masses of mesoblastic cells representing the primitive adrenal. Numbers of the primitive cells from the former enter the mesoblastic tissue, pierce the capsule, and arrange themselves within it as the most external layer of the cells of this organ (Fig. 1). Some of the cells become separated from the nerve tissue, others remain connected to it by nerve-fibers. Some of the cells wander deeper into the gland and become separated from the capsule by a narrow zone of cortical cells (Figs. 2 and 3). As the embryo grows older, more and more of the sympathetic cells enter

the adrenal, so that by the time it reaches the size of 24 mm. the entire adrenal seems studded with them (Fig. 4). To complete the formation of the medullary substance, the cells undergo the following changes: They increase in size by accumulation of plasma, the nucleus enlarges and becomes vesiculated, and, most important of all, when treated with chromic salts the plasma stains intensely brown; the cells have changed into chromaffin cells within the adrenal (Fig. 5).

But only a small portion of the formative cells enters the adrenal; by far the greater number remains along the course of the nerves and plexuses of the sympathetic system, not only in the abdominal cavity, but along the entire system from the neck to the coccyx. They become transformed into chromaffin cells in exactly the same manner as their sister cells within the adrenal. They may remain at these points as isolated cells embedded in the nerve capsule, as agglomerations of cells, or as large chromaffin masses, the paraganglia of Kohn, they may become macroscopically evident. The carotid body, Lushka's coccygeal gland, the accessory bodies at the root of the inferior mesenteric artery first described by Zuckerkandl, and the cell masses in the hypophysis cerebri, first discovered by myself and traced to the sympathetic carotid nerves, are examples of these large groups (Figs. 6 and 7).

These chromaffin cells are in intimate relation to the sympathetic nerves and ganglia, but are never mixed with the ganglion cells, although the latter are derived from another portion of the formative cells.

Concerning the finer structure of the chromaffin cells and their intercellular substance, little need be said, as it corresponds with the often described histology of the medullary substance of the adrenal bodies. The chromaffin bodies possess a scanty amount of areolar intercellular substance, in the meshes of which the specific parenchyma cells are contained. The cells themselves are round or polygonal in shape, indistinct in outline, and possess usually one nucleus, sometimes two; they exhibit a striking affinity for chromic salts above mentioned. Mitotic figures are but rarely observed (Rabl, Ebner, Wiesel); the rich blood-supply of the tissues is also peculiar.

The chromaffin cells are to be found in all vertebrates from fish to man, as demonstrated by numerous authors; wherever a sympa-



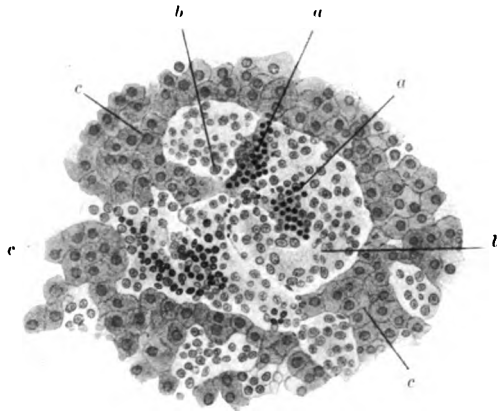


FIG. 5.—Transformation of the sympathetic formative cells into chromaffin cells, in a human embryo, 95 mm. in length. *a*. Formative cells of the sympathetic. *b*. Chromaffin cells. *c*. Cortex.

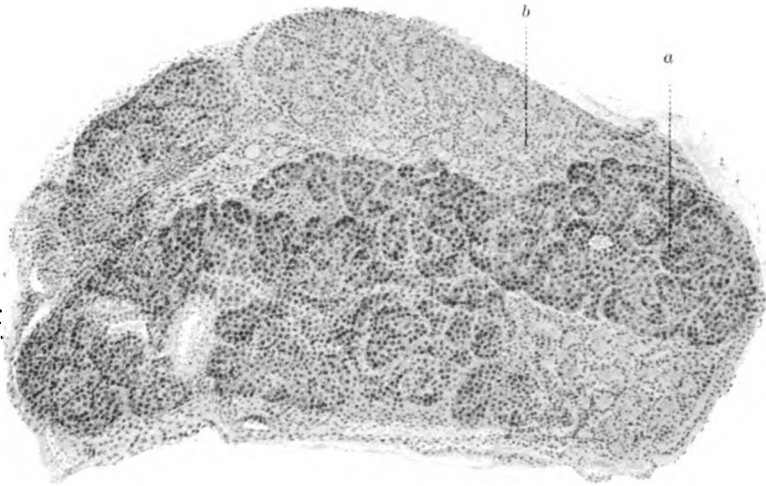


FIG. 6.—Chromaffin cells within a ganglion of the solar plexus, from a child of 3 years. *a*. Chromaffin cells. *b*. Ganglion.

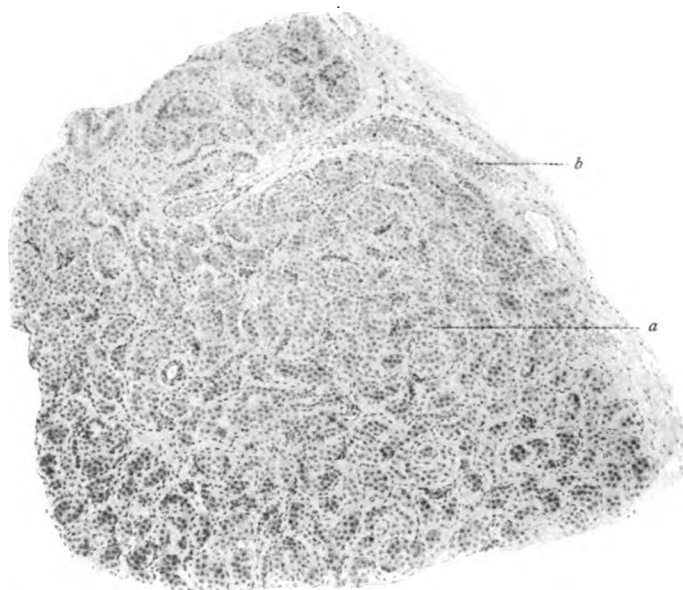


FIG. 7.—Adrenal medulla from a human adult. *a*. Chromaffin cells. *b*. Blood-vessel.

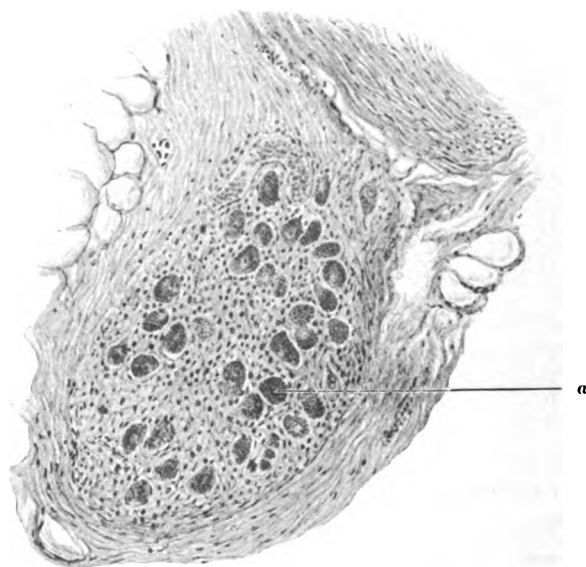


FIG. 8.—Chromaffin ganglion cells of a human adult from a case of Addison disease.  
*a*. Chromaffin cells.  $\times 150$ .

thetic nerve exists they are to be found, and their embryologic origin can always be traced to the sympathetic.

While the relations of the chromaffin cells to the blood-vessels are very important, a genetic connection between the two cannot be traced, even though the carotid body used to be looked upon as a condensation of the vessel walls. The rich blood-supply of the chromaffin bodies is very remarkable; it is much greater than that of the sympathetic ganglia. In the adrenal gland, as well as in the other chromaffin organs, the vessels are arranged in a cavernous manner, and the endothelium of the capillaries is in direct contact with the parenchyma cells, no areolar tissue intervening; in some areas even the endothelium seems to be wanting, large columns of cells projecting directly into the capillaries. Another fact of importance is the presence of chromaffin cells embedded in the walls of the abdominal arteries; they exist there in fishes, amphibia, reptiles, mammalia, and man; in the internal iliac artery I have seen them, for instance, situated in the intima and extending forward as far as the endothelium. I have also found them connected with ganglion cells situated in the ventricular and auricular septa of the new-born child.

In the earlier researches upon the physiology of the adrenal the organ was studied as a whole. But when we consider that the medullary portion, which, though anatomically closely related to the cortex, has an entirely different embryologic origin, and alone contains the chromaffin cells, it is apparent that for the purpose of studying the physiologic function of the chromaffin system, we must entirely disregard the adrenal cortex. The first to recognize this fact were Biedl and I; we employed for our experiments the accessory organs of the sympathetic nerve, they being the purest chromaffin bodies known.

While the influence of an extract of the adrenal body in raising blood-pressure, when introduced into the venous circulation, has been recognized for some time, it has never been definitely determined whether this effect upon the vascular system is produced by the cortical or medullary portion (that is, the chromaffin substance), nor has any investigator experimented with this end in view.

To determine this question, an emulsion made from the accessory chromaffin bodies of Zuckerkandl, which were removed from cada-

vers in as fresh a condition as possible, was injected into animals; the medullary substance was finely triturated and then extracted with a 0.9 per cent. solution of sodium chlorid. Both dogs and cats were used for the experiments. The injection of the prepared extract into the veins of these animals was found to produce the same phenomena as that of the extract of the adrenal body. After a few seconds the blood-pressure rapidly rises, while the pulse becomes slowed and frequently arrhythmic; the pulse change usually occurs while the pressure is at its highest, though sometimes even during its rise; the blood-pressure and pulse frequency return to normal within a short time. The slowing of the pulse is due to an irritation of the vagi, as shown by the fact that it did not occur when, in a number of experiments, the vagi were resected.

Believing the rise in the blood-pressure to be due to contraction of the peripheral vessels, we injected into the veins of a curarized dog an extract prepared of 6 accessory sympathetic organs. Simultaneously with the determination of the arterial blood-pressure the volume of the spleen was measured by means of Roy's oncograph. Coincident with the rise in blood-pressure and decreased frequency in the pulse-rate the pointer of the oncograph rose, to rise still more after section of the vagi. The contraction in splenic volume is a strong proof of the vasoconstrictor effect of the substance. We have repeated these experiments on deeply chloralized rabbits; in one rabbit we found that the blood-pressure gradually rose from 28 mm. Hg to 56 mm. after the injection of the chromaffin substance, and, as the volume of the pulse also rose considerably, we believe it proved that the heart, after these injections, is better nourished and its energy increased. It seems certain, therefore, that the effect of the chromaffin extract upon the blood-pressure is due to a direct influence upon the peripheral vessels and probably to an irritation of the central vasomotor mechanism.

In order to study the direct action of the chromaffin substance on the heart itself, the latter was laid open after Knoll's method and the four chambers connected directly with the myograph, thus registering the curves of the individual cavities. Immediately after the injection of the chromaffin extract into the veins, a reduction of the total volume of the heart could be observed, especially of the left ventricle, which became smaller and paler; immediately afterward marked contraction of both ventricles commenced, more pronounced

in the left, and this continued to increase while the blood-pressure rose; with the decrease of the latter to normal the beating heart also resumed its original size. Further experiments were made with a cat's heart, which, after removal, was artificially nourished by Langendorff's method, and then rinsed with the extract of chromaffin cells. Strong contractions of both ventricles were observed without any considerable change in the frequency of the contractions. The arrhythmia, especially with intact vagi, is worthy of note; it is probably due to functional disturbances of the cardiac mechanism secondary to the increase of arterial pressure, especially as the arrhythmia is frequently bigeminal.

In summing up the results of intravenous injections of an extract of chromaffin cells we find: That the arterial pressure rises considerably; the cause of this is to be found in a contraction of the peripheral vessels; this has its origin partly in an irritation of the vascular nerve-centers and partly in a direct action on the vessels themselves, their non-striated muscle and the peripheral ganglia of the arterial coats. The cardiac muscle is also stimulated into active contraction and a slowing of the pulse-rate results in the normal animal from the central irritation of the vagus.

To observe the effect of other chromaffin bodies, the adrenal bodies of selachians, which also contain chromaffin cells, were experimented with, and with the same result. Similar experiments made by using only the extract of adrenal cortex always resulted negatively as far as the circulatory apparatus was concerned. We can, therefore, conclude that the effects produced upon the circulatory apparatus by therapeutic injections of extract of the adrenal body are due only to the chromaffin cells of the medullary portion. Physiologically we can conclude that the chromaffin cells, whether from the medullary portion of the adrenal or from other chromaffin bodies in any portion of the sympathetic tract, directly excite the nerve and muscle tissue of the vascular apparatus, while the cortical portion of the adrenal body has no such effect. Another action of importance, which should be referred to, is the occasional production of glycosuria when extracts of chromaffin cells are injected either hypodermatically or intravenously (Leo Schwarz). That the chromaffin tissue is an important physiologic element of the animal organism is proved also by the experiments of Zanfragoni and Vasale; they have shown that the extirpation of one portion of

the chromaffin system alone, the medullary substance of the adrenal, produces the death of the animal invariably.

To sum up our present knowledge of the physiology and anatomy of the chromaffin tissue in the light of what has been stated we find: That in the animal there exists a system of well-defined cells and cell aggregates, the chromaffin cells, which embryologically and topographically without doubt belong to the sympathetic nervous system and which possess the property of staining brown when treated with chromates. They are dispersed along the entire course of the sympathetic nerve, forming in some places large accumulations, the largest of which is the so-called medullary portion of the adrenal gland. This connects itself during embryonic days with the epithelial structure of the adrenal, but differs from the cortical substance, both functionally and anatomically. The physiologic activity which these chromaffin cells exert upon the vascular pressure is highly important and peculiar to them; the cortical substance of the adrenal takes no part in this; its function is still unknown. It goes without saying that disease of the chromaffin system is followed by the most serious consequences to the whole organism.

#### **PATHOLOGY OF THE CHROMAFFIN CELLS. ADDISON'S DISEASE**

Since the recognition of this disease by Addison pathologic lesions of the adrenal glands have been held responsible as causative factors, such lesions having been found in the majority of cases which came to autopsy; tuberculosis was discovered most frequently, often also tumors and simple degenerative processes. Of late, however, a number of investigators have reported cases which presented the characteristic clinical manifestations of the disease, and yet post mortem the adrenal glands were healthy; again cases are recorded in which extensive destruction of the adrenals was noted without having produced a single symptom of Addison's disease. For these reasons an attempt has been made by some writers to consider additional sources as causes, especially the sympathetic nervous system, because of its long known close relation to the adrenal bodies. The search for changes in it were very fruitful, a number of lesions in the ganglionic and fibrous portions of the nerves being described, chiefly proliferations of the connective tissue of the interstices, thickening of the blood-

vessels, atrophy of the ganglion cells, and the formation of pigment and lipochrome. These alterations have been found oftenest in the plexuses of the abdominal region, but also in other parts of the sympathetic nervous system, even in the brain and spinal marrow.

It is not necessary to cite and discuss the entire literature upon the subject, it being of no value to the further understanding of it; but it must be stated that neither have the contradictory autopsy findings been satisfactorily explained, nor has it been proved that lesions of the sympathetic nerves may cause Addison's disease, as the pathologic alterations just described do not explain the disease. Brauer, in concluding his excellent monograph on the subject, says that no anatomically demonstrable lesion in the sympathetic nervous system can at present be said to be the underlying factor in Addison's disease. The inconstancy of the histologic changes, which have been described, the unimportance of some of these, their presence in cases which are not Addison's disease, and, lastly, the negative findings in many undoubted cases make it probable that affections of the sympathetic system and Addison's disease do not stand in necessary relation to each other. It is much more probable that the disturbances in the sympathetic are secondary to the still undiscovered cause of Addison's disease or to the marked cachexia; they may probably produce or influence some of the symptoms. Neither disease of the adrenals, of the sympathetic nerves, nor of both together, therefore, can be considered as the basis of Addison's disease. It is true, as Levin pointed out, that in 88 per cent. of all cases lesions of the adrenal are found, but in the remaining 12 per cent. no adrenal disease, and frequently also no sympathetic disease, could be discovered, and this does not take into consideration the cases in which widespread adrenal disease is not associated with symptoms of Addison's disease.

Neusser attempts to explain these contradictory findings by assuming Addison's disease to be the expression of disease of the system in the region of the splanchnic, its central and peripheral nerve-tracts, the intercalary structures and the "Endorgane" (adrenals). He attaches no importance to the localization of the degenerative process, whether found in the spinal cord, along the course of the splanchnics or their celiac ganglion, or in the adrenals, the endorgan, itself. These conclusions are based upon some physiologic experiments, according to which the splanchnic nerves and

their radiations into the solar plexus are to be considered the secretory-trophic nerves of the adrenal; also upon the relation of the terminal nerve filaments and the parenchyma cells of the adrenal, which, as Kölliker describes, permit comparison to an "endtree" in the sense of Waldeyer. These views, held by Neusser, have not yet been proved beyond objection, and if we take into consideration the fact that the sympathetic nerves act as trophic nerves not only to the adrenals but also to other organs, and that diseases of these organs do not extend to the sympathetic nerve, as is seen in Addison's disease, we can well appreciate that there are still many obscure points in the pathogenesis of Addison's disease.

I have had the opportunity of studying anatomically five cases of Addison's disease, recognized as such clinically, and one case presenting no evidence of such, but with advanced tuberculosis of both adrenals. The methods of examination consisted in the removal of both adrenals and of all portions of the sympathetic system which could be obtained, namely, the two chains of ganglia, the large thoracic and abdominal plexuses, including those deep in the pelvis, the hilum of the kidney, and the surrounding fatty and connective tissue in which chromaffin bodies and accessory adrenal glands, consisting only of cortical substance, are frequently found, and the tissue around the origin of the inferior mesenteric artery, the seat of Zuckerlandl's bodies,—in other words, almost the whole sympathetic system. These structures were first studied for their macroscopic appearance; and then fixed in a solution consisting of equal parts of 4 per cent. potassium bichromate and 20 per cent. formalin followed by hardening in 4 per cent. potassium bichromate alone; and then in the usual manner embedded in paraffin or celloidin. Some of the tissue was immediately cut after the fixation process by the freezing microtome and then stained for fat and lipochrome. Many of the sympathetic ganglia were cut in two, and one-half placed directly in 95 per cent. alcohol to serve as a control to those placed in the chrome solution.

Case I was that of a middle-aged male, who came to autopsy presenting the clinical picture of Addison's disease with excessive pigmentation of the skin and of the visible mucous membranes. At the autopsy there was advanced tuberculosis of both lungs; both adrenals were enlarged, firm, and nodular; their capsule could not be stripped in many places, and they were firmly adherent to the



kidneys. Upon section the line of demarcation usually observed between the cortex and the medulla could not be made out; the center of both adrenals was found to contain a cheesy nodule, the size of a pea, surrounded by dense fibrous tissue. There were no accessory adrenals in the periadrenal tissue. Both semilunar ganglia were embedded in dense fibrous tissue and in places adherent to neighboring lymph nodes; instead of being reddish yellow, they were gray in color. The suprarenal ganglia presented similar lesions, but the splanchnic nerves and other chains of ganglia presented no evidence of atrophy. The adrenal bodies, the two chains of ganglia, the cervical ganglia, and the large abdominal plexuses were treated for microscopic examination in the manner mentioned above. The medullary portion of both adrenal bodies was found to be totally disorganized by caseous foci, the cortex only partly so; connective-tissue proliferation was seen throughout the entire organ. There were no accessory adrenals nor chromaffin bodies in the periadrenal tissue. The most important discovery, however, was that in none of the abdominal plexuses nor any other portion of the sympathetic nervous system from neck to pelvis could even a small piece of chromaffin tissue be demonstrated. The absence of these bodies was not observed in control preparations coming from subjects who had died of other diseases.

The other pathologic lesions found in the sympathetic nervous system are such as have been observed by previous investigators: caseous infiltration, connective-tissue proliferation, and blood-vessel changes. Not one of these changes, however, is characteristic of Addison's disease. Only the absence of chromaffin cells throughout the entire sympathetic system and the medullary substance of the adrenal body, which evidently were destroyed by the tuberculous process, is characteristic of Addison's disease, having been found not only in this case, but in all others herein reported, and never in any other disease. Another important change could be found in many ganglion cells of different parts of the sympathetic: While many were normal in size, others were distinctly smaller, and a large number were pigmented; the latter change, however, has been frequently noted and even been considered a physiologic change during old age. By cutting a ganglion into halves and fixing one in alcohol, the other in the bichromate solution, as has been previously described, a comparison was possible. While the histologic picture

was the same after either fixative, the number of pigmented cells observed was much greater after the use of the chrome salt, and much of the pigment of these "chromaffin ganglion cells" was much finer than seen in the ordinary ganglion cell and by other fixatives. No reaction for lipochrome, which is characteristic of the pigment of ordinary ganglion cells, was obtained by staining these "chromaffin ganglion cells" (Fig. 8).

These pigmented cells were true ganglion cells and not simply chromaffin cells as found in the adrenal bodies, as evidenced by the presence of processes and other characteristics of sympathetic ganglion cells, the situation of the cells among nerve-fibers, and their relation one to the other. That during Addison's disease (adrenal disease) some of the ganglion cells of the sympathetic nervous system become chromaffin cells is proved in this and all the other cases by a comparison of the chromated and non-chromated objects, and by an examination of their "pigment" with the freezing microtome. To recall the statement made above once more: the pigmentation of the ganglion cells observed during Addison's disease is not characteristic of it, but may, as Lubinoff has shown, occur in every aged person; furthermore he found, in accord with Rosin and Ferguessi, that the pigmentations of the nervous system react with osmic acid, Sudan III, indophenol, etc., for fat, thus earning for themselves the name lipochromes; but neither the chromaffin cells nor the ganglion cells which have become chromaffined, have ever shown these reactions in any of the many tests performed. The characteristic chromin reaction of the true ganglion cells was observed not only in the cells of the abdominal plexuses, but also in the cells of the thoracic and cervical sympathetic ganglia. As the changes noted in this case have been described so fully, the notes of the following cases will be briefer.

Case II is that of an individual, 35 years of age, with undoubted Addison's disease. The skin and mucous membranes showed intense pigmentation. At the autopsy there was found advanced tuberculosis of both lungs, caseous degeneration of both adrenal glands, and miliary tuberculosis of the peritoneum, caused probably through the rupture of a caseous retrobronchial gland into the pulmonary vein. The microscopic examination was conducted as in the first case. In the capsule of the left adrenal a small accessory adrenal composed of cortical cells was found. The medulla was completely destroyed

by a caseous degeneration, but only a small part of the cortical substance was diseased, the periphery of the organ especially escaping. There were no chromaffin cells found in the sympathetic nervous system, though in examinations of the same structure from persons of the same age dying from other causes such cells could always be found. The sympathetic ganglion cells revealed the same changes as in Case I; in addition to true pigmented ganglion cells there were ganglion cells giving the chromaffin reaction.

Case III was of interest, as only the medullary portion of the adrenal was involved in the tuberculous process, it being changed into a cheesy nodule, the cortex appearing intact. There were no chromaffin cells in the rest of the sympathetic system, the ganglion cells were in part normal, in part pigmented, and in part chromaffin. At the hilum of the right kidney and in the solar plexus accessory adrenal bodies composed of cortical cells only were found. Both this case and Case IV were clinically Addison's disease, the latter case presenting the same characteristics as the former cases.

In Case V both adrenals were transformed into cheesy masses, the sympathetic nerve did not contain any chromaffin cells, whereas some ganglion cells had become chromaffin.

A collective study of the autopsies of these cases teaches us: (1) That the chromaffin cells in the sympathetic system have disappeared and that the medullary substance of the adrenal bodies is intensely involved in the disease process of all the cases.

(2) That the cortical substance in some of the cases is preserved; in all cases at least some of it escapes the disease and such accessory cortical adrenals as were found were not affected.

(3) That the ganglion cells exhibit not only the lipochrome pigmentation which is not characteristic of Addison's disease, but many also show the specific chromaffin reaction, which differs from the lipochrome reaction and corresponds with the reaction of the true chromaffin cells. These changes seem to be characteristic of Addison's disease only, as they were not found after examination of the same tissues from many other subjects dead of other causes, and especially in the light of what was found in the following case in which, despite extensive adrenal tuberculosis, not one symptom of Addison's disease was observed during life.

This case, Case VI, was that of a woman, 20 years of age, who

had been treated for advanced tuberculosis of the lungs. At autopsy there was found to be muscular wasting, but no evidence of pigmentation of skin or visible mucous membranes; diffuse pulmonary tuberculosis with large cavities, tuberculosis of the genitalia, and marked tuberculosis of both adrenal bodies. The latter were enlarged, firm, nodular, firmly adherent to the kidneys, and on section no normal structure could be detected. The interior of the left adrenal contained a large cavity filled with cheesy and broken-down masses. The sympathetic nervous system was normal in appearance macroscopically. Microscopic examination of the adrenals revealed no normal structure with the exception of a small portion of cortical substance. In all parts of the sympathetic nervous system chromaffin tissue was abundantly found, particularly in the large abdominal and pelvic plexuses, where it existed in the form of small and large accumulations of cells; in fact, they existed in much larger quantity than is ever observed in normal persons of this age, and in all probability they represented a compensatory hypertrophy of the chromaffin system to replace the loss in the adrenal body. Chromaffin ganglion cells were nowhere to be found (Fig. 9).

Considering these and the foregoing findings it must seem evident that Addison's disease is a specific affection of the chromaffin system. It consists of a successive atrophy of chromaffin tissue which, as the chromaffin of the adrenal medulla takes part in this degenerative process, spreads secondarily to the adrenal cortex. To compensate for the loss of the chromaffin tissue some of the ganglion cells become chromaffin, the reaction differing from ordinary pigmentation in that it is an absorption and deposition of the chromaffin substance in these cells and not a degeneration. The close anatomic and physiologic relationship between chromaffin and sympathetic ganglion cells points to a vicarious function.

From these points of view it is not difficult to clear up the contradictory opinions thus far advanced for Addison's disease. To begin with, all previous investigations into the nature of Addison's disease lose considerably in value, as in no case was the chromaffin system considered as a whole. The explanation why some cases of extensive adrenal tuberculosis do not present any clinical symptoms of Addison's disease, is to be found in our last case: there is an absence of a general disturbance of the chromaffin system. The

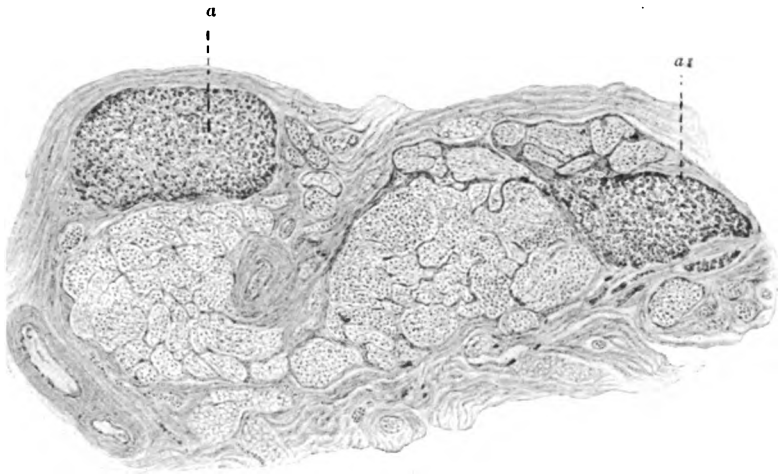


FIG. 9.—Chromaffin cells of the solar plexus, from a case of tuberculosis of both adrenal bodies but without Addison's disease. *a*. Chromaffin cells.  $\times 20$ .



medullary portion of the adrenal gland may be destroyed, but the remaining portion of the sympathetic system is intact, and sufficient chromaffin substance remains to prevent the occurrence of Addison's disease. On the other hand, Addison's disease may exist without disease of the adrenal, medulla or cortex; and though the anatomic proof is wanting, it is probable that lesions in the chromaffin system outside of the adrenal body are sufficient to produce the symptom-complex of the disease. Only thus can the contradictions concerning the etiology of the disease be explained. The main point to be considered is, that in order that symptoms of the disease may appear some considerable portion of the chromaffin system must be affected without regard to the exact location; that it is not necessary for the adrenal gland to be among the diseased structures; and that disease of one portion is compensated for by hypertrophy of others. The fact that the progress of the disease is not checked by the ganglion cells assuming the chromaffin substance after destruction of the medulla of the adrenal, is also explained by the limited number of changed ganglion cells which cannot for any length of time compensate for the large amount of chromaffin substance destroyed. The cortical disease must be considered secondary and of no influence in the production of the disease, because even in the gravest cases undestroyed cortical portions of the main or accessory organs can be found, which, according to our present knowledge of their physiology, suffice in functioning for the destroyed parts.

The disease affecting the chromaffin system oftenest, just as it affects other organs most frequently, is tuberculosis, but whether or not some primary developmental disturbance of the entire system is at times responsible for Addison's disease has not been determined. In the present state of our knowledge of the physiology of chromaffin cells it is not possible to explain all of the clinical symptoms and anatomic findings, as, for instance, the pigmentation of the skin, but considerable light is thrown on the production of two of the grave symptoms of the disease, the hypotonia and adynamia. Recalling the physiologic effect of the chromaffin substance on the vascular tone and the non-striated muscles, we can readily understand that the absence or diminution of this secretion lowers the blood-pressure greatly and through the cerebral anemia produces the adynamia secondarily.

This naturally leads to the thought of a specific therapy of the

disease through the use of the chromaffin substance, and in reality our therapeutic tests with the chromaffin cells of calves have been very encouraging; improvement of the general condition, and even diminution of the pigmentation has been noted, but the substance has been used so recently and in such a limited number of instances that nothing conclusive can as yet be deduced.

#### STATUS THYMICUS

The thymus gland is an organ which ordinarily atrophies during the first few years of life; a number of authors have referred to its occasional persistence beyond the time when involution should have occurred and the association of such persistence with serious disorders and even sudden death. Cases were reported in which sudden death has occurred after insignificant incidents, slight injuries, after bathing, etc., and in which at autopsy nothing was found beyond a large thymus, occasionally also hyperplasia of the lymphatic apparatus, especially of the lymph nodes of the tongue, and the cervical and mesenteric glands. Later, Virchow discovered that in some of these cases a hypoplasia of the arterial system existed in addition, the so-called "congenital narrowness." R. Paltauf, having studied the status thymicus extensively, believes that it is a part of a general developmental disturbance, the further details and causes of which are still unknown, but in which the cardiac changes are the most important. During narcosis death sometimes occurs, and nothing but the status thymicus can be found. Clinically all these cases have in common symptoms of cardiac weakness and progressive lowering of blood-pressure, which may cause convulsions secondarily from cerebral anemia, and which produce death in a short time. At autopsy nothing beyond what has just been stated is detected, though sometimes no lesion whatever can be found. I have had the opportunity of examining several cases of status thymicus post mortem, and have found changes which seem to throw some light upon the etiology of these sudden deaths, and may suggest how treatment in the event of dangerous symptoms should be applied. None of the theories advanced to explain the sudden serious symptoms of status thymicus have stood the test of investigation, especially not that of Paltauf, who claimed that they were due to compression of the trachea by a sudden swelling of the thymus.



The first case was that of a well-built, normally-sized man, 20 years of age, whose previous history showed that, though he tired easily when walking quickly, he had always enjoyed good health. Suddenly after leaving the bath he lost consciousness. He became cyanosed, developed slight clonic twitching of the extremities, and died within 24 hours without having recovered consciousness. At autopsy there was found hyperemia of all organs, a thymus gland the size of an apple and hard in consistency, and hyperplasia of the lymph nodes at the base of the tongue and in the neck; the lymph glands of the mesentery and the spleen were normal, the blood-vessels of normal size, and the genital organs well developed. The adrenal bodies were quite small and upon section the medullary substance represented a mere strip  $\frac{1}{4}$  mm. in width (normally 4 to 5 mm.), barely visible to the naked eye, the cortical portion seemingly of normal configuration and width. The remainder of the sympathetic system seemed normal except that there were no accessory adrenals nor chromaffin masses to be seen among the large abdominal plexuses. Upon microscopic examination a hypoplasia of the medulla was found to be present, the medullary substance being composed of only a single zone of cells, about 20 in number, and surrounding a central vein. The cortex was normal, and not being separated by the usual medullary substance, the inner zones were nearly in contact, being merely prevented from close approximation by the centrally situated blood-vessels. There were but few chromaffin cells in the rest of the sympathetic nervous system, so that I consider myself justified in believing that in this case a congenital hypoplasia of the chromaffin system was coincident with status thymicus.

That this coincidence was not accidental in the foregoing case is proved by the observation of a second: A strong man, 40 years of age, fell from a scaffold and was brought unconscious to the hospital. Symptoms of grave internal hemorrhage developed, the abdomen was opened and the left kidney was found ruptured, and was then sutured. He died within two days with signs of increasing cardiac weakness. At the autopsy, in addition to the conditions mentioned, a persistent thymus of hard consistence and the size of a fist was found. The lymph nodes at the base of the tongue and of the neck were distinctly hyperplastic. The adrenal bodies were strikingly small—apparently all cortex save a narrow central

strip; microscopically there was marked hypoplasia of the entire chromaffin system, as well as of the medullary substance of the adrenals.

A third case supports the thought advanced in the earlier portion of this paper, that Addison's disease may probably be due to a congenital developmental disturbance of the chromaffin system. A male, 15 years of age, died with the clinical symptoms of Addison's disease. There were marked pigmentation, which had gradually increased during life, great prostration, and diminished blood-pressure. The autopsy revealed an old tuberculosis of both lungs, marked status thymicus, and hypoplasia of the chromaffin system. The adrenal bodies were smaller than normal, the cortex normal, the medullary substance on the right side represented by a narrow strip, and replaced by a small mass on the left side, which microscopically proved to be a tubercle. There were no chromaffin cells in the remainder of the sympathetic system, though the fibrous and ganglionic portions were normal, and some of the ganglion cells had become chromaffin.

In another case hypoplasia of the chromaffin system was found associated with hypoplasia of the vascular apparatus and the genitalia. The case occurred in a female, 20 years of age, who died of tuberculosis of the lungs. At autopsy the axillæ and pubis were found free of hair, the breasts infantile, and the nipples without pigment; the girl was apparently only about 12 years old. Advanced tuberculosis of the lungs was present; the heart concentrically hypertrophied; all the arterial vessels under-developed; the aorta hardly admitting the little finger, the other arteries narrow and thin-walled; the internal genitalia infantile, the ovaries being smooth and without evidence that ovulation had ever occurred; the adrenal organs were quite small. Upon microscopic examination the medullary substance of the adrenal bodies was found to consist of about 15 cells only, resembling in their structure those cells which we have previously described as the "formative cells of the sympathetic nerve" and reacting but slightly to the chrome salts (Figs. 10 and 11). The remaining portion of the sympathetic nerve exhibited a few chromaffin cells more or less embryonic in appearance.

In a case of hemophilia I found hypoplasia of the entire chromaffin system, but would not draw conclusions from this single observation.

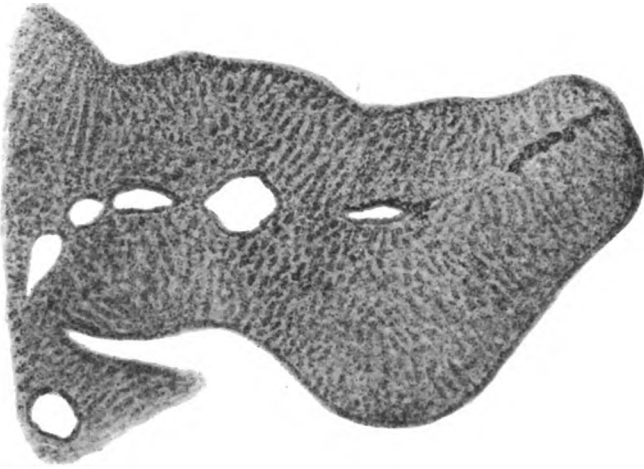


FIG. 10.—Hypoplasia of the adrenal medulla, with hypoplasia of the vascular system.  $\times 20$ .

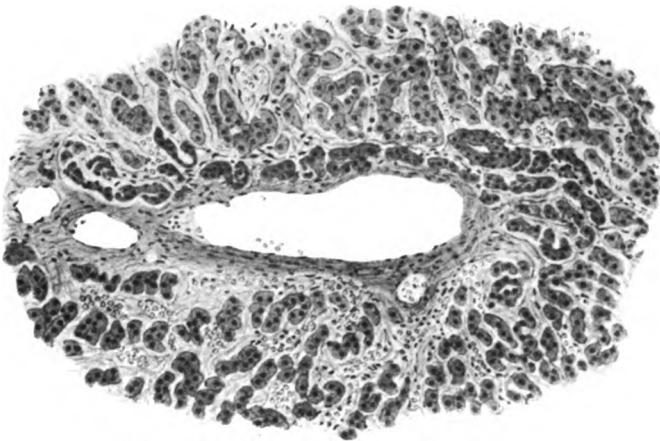


FIG. 11.—Hypoplasia of the adrenal medulla, with hypoplasia of the vascular system.  $\times 180$ .  
(From the same case as Fig. 10.)



It is probable, however, that the hypoplasia of the chromaffin system associated with the status thymicus will explain the sudden deaths for which thus far only the persistent thymus gland has been discovered. If we remember that the chromaffin cells perform an important physiologic function by supplying a secretion, which supports the blood-pressure and influences the tonicity of the vessel walls and cardiac muscle, it can readily be understood why slight influences inducing a diminution of cardiac activity and blood-vessel tone, such as the cold bath or narcosis, may be followed by serious consequences. Normally these events have no effect, but when the substance which influences the function of the heart and regulates the blood-pressure is absent or diminished in quantity, excessive fluctuations in the blood-pressure mechanism may cause death from atony and dilatation of the heart and blood-vessels, intestinal hyperemia, and cerebral anemia. The autopsy findings bear this out, cardiac dilatation, hyperemia of the intestinal vessels and anemia of the brain having been noted in all the cases of sudden death from status thymicus reported in the literature. These conditions should not be traced to the thymus, but rather to the associated hypoplasia of the chromaffin system. It would certainly be well worth while to try, therapeutically, the effect of injections of chromaffin substance from the medulla of adrenal glands in cases in which the onset of collapse symptoms occurs after a cold bath, narcosis, etc., and suggests the existence of status thymicus.

I trust that these investigations may stimulate further research, and I believe that many obscure lesions may be elucidated by a systematic study of the anatomy and physiology of the chromaffin system. It is certain that in the future it must occupy a prominent position in the pathology of the adrenals and the sympathetic nerve.

#### REFERENCES.

KOHN, Ueber die Nebenniere, *Prag. med. Woch.*, 1898. Die Nebenniere der Selachier nebst Beiträge zur Kenntniss der Morphologie der Wirbeltieren-nebenniere, *Arch. f. mikroskop. Anat.*, 1898. Die chromaffin Zellen des Sympatheticus, *Anatom. Anzeiger*, 1899. Chromaffine Zellen, etc., *Prag. med. Woch.*, 1902. Die Paraganglien, *Arch. f. mikroskop. Anat.*, 1903.

WIESEL, Accessorische Nebennieren am Nebenhoden des Menschen, *Wien. klin. Woch.*, 1898. Ueber compensationshypertrophie accessorischen Nebennieren, *Centralblatt f. Physiologie*, 1899. Accessorische Nebennieren, etc., *Sitzungsberichte d. k. Akad. d. Wissenschaften, Wien*, 1898, Bd. 108. *Entwick.* Vol. II.—Ser. 15—20

lung der menschl. Nebenniere, Centralbl. f. Physiologie, 1900, Anat. Hefte. Entwicklung der Nebenniere des Schweines, Anat. Hefte, 1899.

WIESEL und BEIDL, Ueber die functionelle Bedeutung der Nebenkörper des Sympatheticus, etc., Arch. f. d. ges. Physiologie, 1902. Chromaffine Zellen in der Gefasswänden, Centralbl. f. Physiologie, 1903. Zur Pathologie des Morbus Addison's, Zeitschrift für Heilkunde, 1903. Hemicephalie und chromaffine Zellen, Sitzungsberichte der Gesellschaft f. innere Medizin in Wien, 1904. Zur Pathologie der chromaffinen Zellen, Virchow's Archiv, 1904.

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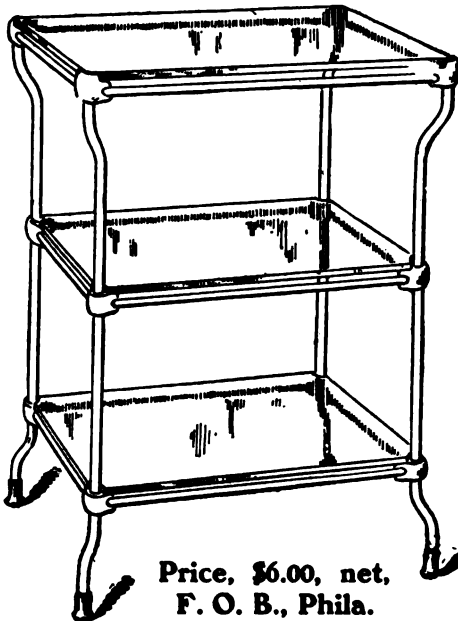
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